CARL E. GILBERT ELEMENTARY SCHOOL – TK/PK CLASSROOMS & EARLY LEARNING BUILDING

DSA File No. 30-4
App. No. 04-123212
PTN. 66456-65

BUENA PARK SCHOOL DISTRICT

MARCH 29, 2024

PROJECT #23076

Studio W Architects

STUDIO W
ARCHITECTS

SEALS PAGE

Carl E. Gilbert Elementary School – TK/PK Classrooms & Early Learning Building

OWNER:
Buena Park Unified School District
8201 Country Club Dr.,
Buena Park, CA 90621

ARCHITECT:
Studio W Architects
1930 H Street
Sacramento, CA 95811

BY:_____
Brian R. Whitmore, AIA CA 30345

ELECTRICAL ENGINEER:
FBA ENGINEERING
150 Paularino Ave, Ste A120
Costa Mesa, CA 92626

BY:_____
Stephen R. Zajicek, PE E10372

STRUCTURAL ENGINEER:
Welsh Structures, INC.
12722 Barrett Lane
Santa Ana, CA 92705

BY:_____
Stephanie Welsh, SE S2998

well beyond design.

STUDIO W
ARCHITECTS

SEALS PAGE

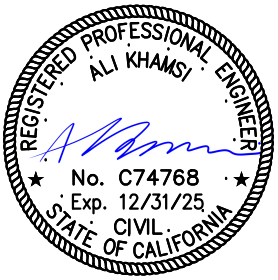
Carl E. Gilbert Elementary School – TK/PK Classrooms & Early Learning Building

OWNER:
Buena Park Unified School District
8201 Country Club Dr.,
Buena Park, CA 90621

CIVIL ENGINEER:
KPFF
140 Newport Center Drive, Suite 100
Newport Beach, CA 92660

BY:_____

Ali Khamsi C 74768



well beyond design.

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Use of premises.
   3. Work restrictions.
   4. Specification formats and conventions.
   5. Pollution Control.
   6. Storm Water Pollution Prevention Plan.
   7. Lead-Containing materials.
   8. Additional DSA requirements.

B. Related Sections include the following:
   1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Carl E. Gilbert Elementary School – TK/PK Classrooms & Early Learning Building.

B. Owner: Buena Park School District.

C. Project Location: Gilbert Elementary School.

D. Project Address: 7255 8th Street, Buena Park, California 90621.

E. Architect: Studio W Architects.

F. The Work consists of the following:
   1. The Work includes construction of classrooms and site work and as indicated on Drawings.
   2. The intent of these drawings and specifications is that the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the contract documents wherein the finished work will not comply with Title 24, California Code of Regulations, a Construction Change Document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by Division of the Sate Architect before proceeding with the repair work.

1.3 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.4 WORK RESTRICTIONS

A. On-Site Work Hours:
1. Work shall be generally performed inside the existing building during normal business working hours, Monday through Friday, except otherwise indicated.

1.5 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 49-division format and CSI's MasterFormat 2004 numbering system.
1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.6 POLLUTION CONTROL

A. Provide positive methods, means and facilities required to prevent contamination of the soil, water or atmosphere by the discharge of noxious substances from the construction operations.

1.7 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. The contractor shall submit a Storm Water Pollution Prevention Plan for approval by the City's Public Works and Community Development Departments. The plan shall show erosion control measures and indicate locations of staging, fueling, equipment and employee parking, and storage/stockpile locations. Locations for concrete washout shall be shown, as well as gravel site entrances and/or metal grates to keep soil from being deposited on City streets. The plan shall note that street sweeping shall occur as often as necessary, to ensure that no dirt or dust will remain on City streets. Drip pans shall be used under parked equipment and visqueen shall be shown on the plan to protect the soil in the fueling area. Only minor vehicle maintenance shall occur on-site. Maintenance shall occur in the fueling area and soil shall be protected by drip pans and visqueen.

B. Prepare a Storm Water Pollution Prevention Plan (SWPPP) and file a Notice of Intent with the State Water Resources Control Board for this project. The SWPPP will provide Best Management Practice (BMP) methods and controls for wet weather grading activities and erosion control for both onsite and offsite improvements, in accordance with the requirements of the NPDES General Permit for Storm Water Discharges Associated with Construction Activity. The SWPPP shall include an erosion control plan.

1.8 MISCELLANEOUS PROVISIONS

A. General: Comply with the Project Conditions of Approval for both noise and dust control. If there is any conflict between drawings and specifications and the Project Conditions of Approval regarding noise and dust control, the Project Conditions of Approval shall govern.

B. Noise Control: The Contractor shall install noise reducing devices on construction equipment. Contractor shall comply with the requirements of the city and county having jurisdiction with regard to noise ordinances governing construction sites and activities. Construction Equipment noise at the Site shall be limited and only as permitted by applicable law, rule or regulation. If classes are in session at any point during the progress of the Work, and, in the Owner's reasonable discretion, the noise from any Work disrupts or disturbs the students or faculty or the normal operation of Owner, at the Owner's request, the Contractor shall schedule the performance of all such Work around normal hours or make other arrangements so that the Work does not cause such disruption or disturbance. In no event shall such arrangements result in adjustment of the Contract Price or the Contract Time.

C. Dust Control. The Contractor shall be fully and solely responsible for maintaining and upkeeping all areas of the Site and adjoining areas, outdoors and indoors, free from flying debris, grinding powder, sawdust, dirt and dust as well as any other product, product waste or work waste, that by becoming airborne may cause respiratory inconveniences to persons, particularly to students and Owner's personnel. Additionally, the Contractor shall take specific care to avoid deposits of airborne dust or airborne elements. Such protection devices, systems or methods shall be in accordance with the regulations set forth by the EPA and OSHA, and other applicable law, rule or regulation. Additionally, the Contractor shall be the sole party responsible to regularly and routinely clean up and remove any and all deposits of dust and other elements. Damage and/or any liability derived from the Contractor's failure to comply with these requirements shall be exclusively at the cost of the Contractor, including, without limitation, any and all penalties that may be incurred for violations of applicable law, rule or regulation, and any amounts expended by the Owner to pay such damages shall be due and payable to the Owner on demand. Contractor

shall replace any damages property or part thereof and professionally clean any and all items that become covered or partially covered to any degree by dust or other airborne elements. If classes are in session at any point during the progress of Work, and, in the Owner's reasonable discretion, flying debris, grinding powder, sawdust, dirt or dust from any Work disrupts or disturbs the students or faculty or the normal operation of the college, at the Owner's request, the Contractor shall schedule the performance of all such Work around normal college hours and make other arrangements so that the Work does not cause such disruption or disturbance. In no event shall such arrangements result in adjustment of the Contract Price or the Contract Time.

1.9 LEAD-CONTAINING MATERIALS.

A. The Contractor shall assume that all ceramic tile and painted or varnished surfaces in the school district contain detectable levels of lead which trigger compliance with California Code of Regulation, Title 8, Section 1532.1. In addition, waste products from these materials could contain lead at levels which are subject to the hazardous waste requirements in the California Code of Regulations, Title 22, Sections 666260.1 - 66263.12 and 66268.1 - 66268.124 and the health and Safety Code Section 25157.8 and 25163, subdivision (c).

B. It is the Contractor's responsibility to handle and dispose of these materials in accordance with the regulations. If failure to comply with these regulations results in a site or worker contamination, the Contractor will be held solely responsible for all costs involved in any required corrective action.

C. Lead-based paint should be removed only by professionals trained in hazardous material removal. A trained professional must follow very detailed procedures to minimize, control and contain lead dust generated by the removal process.
   1. The room should be sealed from the rest of the building. All furniture, carpets and drapes should be removed.
   2. Workers should wear respirators designed to avoid inhaling lead.
   3. No eating or drinking should be allowed in the work area. All food and eating utensils should be removed from the room. All cabinets as well as food contact surfaces should be covered and sealed.
   4. Occupants should be kept out of the room until the job is completed.
   5. Clothing worn in the room should be disposed of after working. The work clothing should not be worn in other areas of the building.
   6. Debris should be cleaned up using special vacuum cleaners with HEPA (high efficiency particle absorption) filters. A wet mop should be used after vacuuming.

1.10 ADDITIONAL DSA REQUIREMENTS

A. Comply with the following:
   1. Compliance with Title 24, for Parts 1-6 and 9.
   2. Title 24, Parts 1-5 shall be kept on site during construction.
   3. If any conflict or inconsistencies exist between the specifications and the drawings (including the general notes), more stringent requirements shall take precedence.
   4. Addenda:
      a. In accordance with Section 4-338(a) of the California Administrative Code, changes or alterations of the approved plans and specifications prior to the letting of a construction contract for the Work shall be made by means of addenda, which shall

be submitted to and approved by Division of the Sate Architect (DSA) prior to distribution to contractors.

b. Addenda shall be stamped and signed by Architect or Engineer in general responsible charge of preparation of the plans and specifications, and by the Architect or Engineer delegated responsibility for the portion affected by the addenda.

c. Addenda issued during bidding, if any, will be inserted following this page in the Contract Documents sets issued for construction. The provision of all addenda shall become part of the Contract Documents and Contractor shall be obligated to construct the Project in accordance with the Contract Documents as modified or supplemented by the addenda provisions.

5. All substitutions affecting DSA regulated items shall be considered as a Construction Change Document or Addenda, and shall be approved by DSA prior to fabrication and installation. (IR-A6) (Section 4-338(c), Part 1)

6. Construction Change Document (Section 4-338 (c), Part 1) must be signed by all the following:
   a. A/E of Record.
   b. Owner (change order only).
   c. SEOR (when applicable).
   d. Delegated Professional Engineer (when applicable).
   e. DSA.

7. Project Inspector and testing lab must be employed by the Owner and approved by all of the following:
   a. A/E of Record.
   b. SEOR (when applicable).
   c. DSA.

B. Tests and Inspections - Chapter 17A:

1. All tests shall be performed by a testing facility acceptable to the architect and DSA. The testing facility shall be directly employed by the school district and no other entity or individual. Section Title 24, Part 1, Section 4-333 and 4-335.

2. Test reports shall be addressed to, and sent to, the school district by the testing facility. Copies of all test reports shall be sent to DSA, the architect, the structural engineer, and the project inspector by the testing facility. All reports shall be sent within 14 days of the date of the test. See Title 24, Part 1, Section 4-333 and 4-335.

3. A Verified Report, sighed by the California licensed civil engineer in charge of the testing facility which conducted the tests, shall be submitted to DSA upon completion of the project. The verified report shall state that all tests and inspections were made as required by the DSA approved documents. If the tests or inspections indicate that materials or workmanship did not meet the requirements of the DSA approved documents, the Verified Report shall list all noncompliant work. A copy of all test reports involving unresolved noncompliant work shall be attached to the Verified Report. In the event that not all required tests or inspections were made by the testing facility making this verified report, those tests and inspections not made shall be listed on the Verified Report. See Title 24, Part 1, Section 4-333 and 4-335.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.2 MINOR CHANGES IN THE WORK

A. Architect may issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, or Changes not affecting the Structural Safety, Access Compliance or Fire & Life Safety portions of the work, on AIA Document G710, "Architect's Supplemental Instructions" or an equivalent form acceptable to District and subject to DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements for DSA Construction Change Document – Category B.

1.3 PROPOSAL REQUESTS (BULLETIN)

A. Owner-Initiated Proposal Requests: Architect may issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

1.4 CONSTRUCTION CHANGE PROCESS - DSA

A. Changes or alterations of the approved plans or specifications after a contract for the work has been let affecting the Structural, Access or Fire-Life Safety portions of the project shall be made only by means of Construction Change Documents submitted to and approved by DSA prior to commencement of the work shown thereon. Construction Change Documents shall comply with DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements. Construction Change Documents shall be made using DSA form 141 and state the reason for the change and the scope of work to be accomplished, and, where necessary, shall be accompanied by supplementary drawings referenced in the text of the change order. All Construction Change Documents and supplementary drawings shall be stamped and signed by the architect or engineer in general responsible charge of observation of the work of construction of the project and by the architect or registered engineer delegated responsibility for observation of the portion of the work of construction affected by the change order, shall bear the approval of the school board and shall indicate the associated change in the project cost, if any. One copy of each Construction Change Documents is required for the files of DSA.

B. Construction Change Documents shall be signed by Architect of Record, Owner, Structural Engineer (when applicable), Delegated Professional Engineer (when applicable), and DSA.

C. No changes shall be made to approved documents without DSA approval.

D. All Construction Change Documents shall be signed by Architect and approved by DSA.

1.5 CONSTRUCTION (FIELD) CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.
   3. No payment applications will be signed by the Architect prior to the Contractor submitting, and the Architect reviewing, a schedule of values.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Submit draft of AIA Document G703 Continuation Sheets.
   3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.

g. Dollar value.
1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be 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. The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.
   6. Submittals Schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Data needed to acquire Owner's insurance.
   15. Initial settlement survey and damage report if required.

G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Project meetings.
   2. Requests for Interpretation (RFIs).

B. Related Sections include the following:
   1. Division 1 Section "Submittal Procedures" for electronic submittals.
   2. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
   3. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   4. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.

3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

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

1.3 SUBMITTALS

A. Submit electronic submittals directly to extranet specifically established for Project.

1.4 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
4. Frequency of Attendance by Architect: Limited by Architect/Owner Contract.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.
   b. Phasing, if any.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for RFIs.
   g. Procedures for testing and inspecting.
   h. Procedures for processing Applications for Payment.
   i. Distribution of the Contract Documents.

j. Submittal procedures.
k. Preparation of Record Documents.
l. Use of the premises.
m. Work restrictions.
n. Owner's occupancy requirements.
o. Responsibility for temporary facilities and controls.
p. Construction waste management and recycling.
q. Parking availability.
r. Office, work, and storage areas.
s. Equipment deliveries and priorities.
t. First aid.
u. Security.
v. Progress cleaning.
w. Working hours.

3. Minutes: Record and distribute meeting minutes electronically.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. The Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility problems.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written recommendations.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        1) Review schedule for next period.
    b. Review present and future needs of each entity present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) RFIs.
        16) Status of proposal requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.
3. Minutes: Record the meeting minutes electronically.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.5 RFIs:

A. General:
1. Contractor may submit a RFI to the Architect seeking clarification or interpretation of the contract documents. If in the Contractor's opinion the nature of the RFI requires a discussion, rather than simply an answer, the Contractor shall call the Architect to have such a discussion. The results of that discussion as well as all other RFI's must be presented in writing on a form approved in advanced by the Architect along with any supporting information or data, as well as the Contractor's recommended resolution. An oral RFI or a RFI presented on an unapproved form, or without adequate supporting information and Contractor's recommended solution, will be attributed solely to the contractor. Architect's review of or responses to RFI's shall not constitute an approval, direction, or procedure related to the construction means, methods, techniques, sequences, or procedures of the Contractor.
2. Architect's review of or responses to RFI's shall not constitute an approval, direction, or procedure related to the construction site safety precautions, procedures, or methodology of the Contractor.
3. The use of a RFI is limited to clarification of the contract documents. Contractor will limit each RFI to a single issue. Information which is discernable from the contract documents; construction means and methods; product substitution submittals; product submittals; and construction site safety will not be addressed by the Architect in responding to a RFI.
4. Architect's response to a RFI is not a change order or directive authorizing an increase in construction cost or time.

B. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

C. Frivolous or Unnecessary RFIs: Cost of design professional’s time will be billed or deducted from progress payment.

D. Electronic RFIs: Follow vendor’s instruction.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 21 days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or RFIs with numerous errors.
2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

F. RFI Log: Prepare, maintain, and submit as instructed by electronic submittal vendor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FORMS

A. Electronic versions of attached forms will be provided upon request.
    1. RFI Form.

END OF SECTION 013100

STUDIO W
ARCHITECTS

RFI FORM

Project Name: **RFI No.:**
Project No.:
To: **Date:**
From:

Subject:
Discipline: **Category:**
Specification Section Title:
Section No.: **Page:** **Article/Paragraph:**
Sheet No.: **Detail:**

Question:

Suggestion:
☐ **Attachment:**
Undersigned certifies:

- Both drawings and specification sections were thoroughly reviewed.
- Processing time for frivolous RFIs will be charged back to Contractors at A/E billable rates.

Desired Response Date: (However, A/E still have specified days to respond.)
Cost Impact: **Schedule Impact:** days
Drawing Impact: **Submitted by:**
Signed: **Date:**

Answer:

Answered by:
Signed: **Date:**

Copies: ☐ **Owner** ☐ **Consultants** ☒ ☐
☐ **File**

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1. A/E review of or responses to RFI's shall not constitute an approval, direction, or procedure related to the construction site safety precautions, procedures, or methodology of the Contractor.
2. The use of a RFI is limited to clarification of the contract documents. Contractor will limit each RFI to a single issue. Information that is discernable from the contract documents; construction means and methods; product substitution submittals; product submittals; and construction site safety will not be addressed by the A/E in responding to a RFI.
3. A/E response to a RFI is not a change order or directive authorizing an increase in construction cost or time.

End of RFI Form

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Three Week Look-Ahead Schedule.
   4. Daily construction reports.

B. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or review.

B. Contractor's Construction Schedule: Submit three opaque copies of schedule, large enough (minimum 11 x 17) to show entire schedule for entire construction period.

C. Daily Construction Reports: Submit two copies at weekly intervals.

1.3 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Concurrent with the development of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the submittal schedule with the Contractor's construction schedule described above.
   1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
   2. The Architect will review the schedule and indicate which submittals may be deleted from the submission requirement. The deletion of the submittal requirement for an item does not release the Contractor from any requirements of the Construction Contract, General Conditions or Plans and Specifications.

B. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
   1. Scheduled date for the first submittal.
   2. Related Section number.
   3. Submittal category.
   4. Name of subcontractor.
   5. Description of the part of the Work covered.
   6. Scheduled date for resubmittal.
   7. Scheduled date the Architect's final release or review.

C. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
   1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit within 15 days of the date established for "Commencement of the Work". The Construction Schedule must be submitted and accepted prior to approval of first pay application.
   1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as identified in the "Schedule of Values".

2. Within each time bar indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.
3. Prepare the schedule on a sheet, or series of sheets, of stable reproducible media, of sufficient width to show data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating "pre-calculated" and "actual" costs. On the line show dollar-volume of work performed as of the dates used for preparation of payment requests.
1. Refer to Section "Payment Procedures" for cost reporting and payment procedures.

2.3 THREE WEEK LOOK-AHEAD SCHEDULE

A. Prepare weekly (or as determined by scheduled meeting times), prior to Project meetings, a computer-generated 3-week look-ahead schedule (bar chart) which is consistent with the Contractors schedule and depicts daily labor activities. The schedule will consist of the prior week, current week and the following 3 weeks.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.

8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates changes, including, but not limited to, changes in durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of reviewed schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Submittals Schedule Form.

END OF SECTION 013200

SUBMITTAL SCHEDULE FORM

☐ Preliminary Submittal Schedule: Include submittals required during the first 60 days of construction.
☐ Complete Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

Project: From:

To: Date:

Scheduled Initial Submittal Date	Spec Section		Type: ☐ Action ☐ Info Only	Name of Subcontractor	Description	Scheduled Date of Approval
	No.	Title				

End of Submittal Schedule Form

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for electronically submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Consult individual sections of specifications for specific submittals required under those sections and for further details and descriptions of requirements.

C. Related Sections include the following:
1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Quality Requirements" for submitting test and inspection reports.
5. Division 1 Section "Closeout Procedures" for submitting warranties.
6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
7. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Division 1 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
9. Other Sections for specific requirements for submittals in those Sections.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. Processing: All costs for electronic submittal, printing, preparing, packaging, mailing, or delivering submittals for initial submittals and all costs for re-printing, re-drawing, re-drafting, re-packaging, re-submitting, and re-mailing or re-delivering as required for all re-submittals shall be included in Contract Sum.

B. Sequence: Transmit each submittal in sequence which will not result in Architect’s approval having to be later modified or rescinded by reason of subsequent submittals which should have been processed earlier or concurrently for coordination.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

E. Multiple Reviews: The Contractor shall also be responsible for all costs to Architect or Architect consultants for reviews requiring more than 2 reviews for same specification section.

F. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Review: Allow 21 days for review of each submittal. Architect will request for more time if needed.

G. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked “Approved” or “Furnish as Noted”.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating approval by Architect.

1.4 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
   1. Submit request using attached form at end of section.
      a. Indicate date, project name, contractor name, address, and specific drawing (sheet number) required.
      b. Signed by Contractor agreeing with terms and conditions.

PART 2 - PRODUCTS

2.1 ELECTRONIC SUBMITTALS

A. General: Prepare and submit Submittals required by individual Specification Sections.
   1. Submit electronic submittals directly to extranet specifically established for Project.
   2. Vendor:
      a. Submittal Exchange (Basis of Design)
      b. Or equal.
   3. Contractor shall pay for all-inclusive use of Submittal Exchange by all project team members; data storage, security, and backup; setup, training, and support; and archiving once construction is complete.
      a. Documentation processed, housed and archived shall include but not limited to: Submittals, Addendum, Plans, Specs, Field Reports, Photos, Weekly Reports, Notice of deviations, Punch List, RFI's RFP's ASI's, CCD's, Cost Proposals, Test Reports, Meeting Notes., and Close Out.

2.2 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
      a. Circle items applicable.
      b. Cross-out items not applicable.
      c. Select item number if required.
   3. Submittal data must include complete documentation relating to all the specified features
   4. Include the following information, as applicable:
      a. Manufacturer's Submittal Form with all the options selected when available.
      b. Manufacturer's written recommendations.
      c. Manufacturer's product specifications.
      d. Manufacturer's installation instructions.
      e. Standard color charts.
      f. Manufacturer's catalog cuts.
      g. Wiring diagrams showing factory-installed wiring.
      h. Printed performance curves.
      i. Operational range diagrams.
      j. Mill reports.
      k. Standard product operation and maintenance manuals.
      l. Compliance with specified referenced standards.
      m. Testing by recognized testing agency.
      n. Application of testing agency labels and seals.
      o. Notation of coordination requirements.
   5. Submit Product Data before or concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Dimensions.
      b. Do not use words "by others." Identify exactly who is responsible for the work.
      c. Identification of products.
      d. Fabrication and installation drawings.
      e. Roughing-in and setting diagrams.
      f. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      g. Shopwork manufacturing instructions.
      h. Templates and patterns.
      i. Schedules.
      j. Design calculations.
      k. Compliance with specified standards.
      l. Notation of coordination requirements.
      m. Notation of dimensions established by field measurement.
      n. Relationship to adjoining construction clearly indicated.
      o. Seal and signature of professional engineer if specified.
      p. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
   3. Number of Copies: Submit 4 sets of prints and one electronic copy.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of appropriate Specification Section.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit 1 full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and

physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
    1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

2.3 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
2. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification

(WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

L. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation

of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.

Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

2.4 DEFERRED APPROVALS AND DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit 3 copies of a statement, signed and sealed by Structural Engineer Licensed in

California, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
   1. Coordinate the work; do not delegate responsibility for coordination to any subcontractor.
   2. Anticipate the interrelationship of all subcontractors and their relationship with the total work.
   3. Resolve differences or disputes between subcontractors and materials suppliers concerning coordination, interference, or extent of work between sections.
   4. Trade submittals with “By Others”, “By General Contractor”, or similar coordination and work scope are not allowed. Identify, acknowledge, and resolve scope of work prior to submittal by Contractor. No extras will be allowed. Provide complete and coordinated submittals.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

F. Architect’s and Consultant’s review shall neither be construed as complete check nor relieve the Contractor, Subcontractor, manufacturer, fabricator, or supplier from responsibility for any

deficiency that may exist or from any departures or deviations from the requirements of the Contract unless the Contractor has, in writing, called the Architect's attention to the deviations at the time of submission as specified.

3.3 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Electronic Files Transfer - Architectural Form.

END OF SECTION 013300

Subject: Architectural Electronic Files

Date: _____

Contractor Name: _____

Address: _____

Project: _____

At your request, we will provide electronic files for your convenience and use in the preparation of shop drawings related to _____, subject to the following terms and conditions:

Our electronic files are compatible with AutoCAD. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.

Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or sub consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files.

These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by us and the electronic files, the signed or sealed hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display.

We will furnish you electronic files of the following architectural drawings: _____.

Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by us, and we make no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall we be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

If these terms are acceptable to you, please sign in the space provided below as evidence of our mutual understanding and agreement for this service. One signed copy of this agreement shall be returned to our office prior to delivery of the electronic files.

Very truly yours,

Architect

_____ _____

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:
   1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Other Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups:
   1. Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
   2. Comprehensive, completely integrated mockups of separate trades showing interface conditions, transitions, and relationships between materials and finishes.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.

3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A licensed professional engineer who is legally qualified to practice in California and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system,

assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An DSA approved NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.6 QUALITY CONTROL

A. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

E. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes list of references.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. “AHJ”: Agency having jurisdiction.

C. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

D. “Compatible”: When used for products, it shall comply with requirements including products recommended/ required by the manufacturer for warrantee acceptance.

E. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

F. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

G. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

H. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

I. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

J. “Owner”: As defined in Division 1 section “Summary”.

K. "Provide": Furnish and install, complete and ready for the intended use.

L. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
   2. Copies of standards and applicable building codes (Title 24 Parts 1-5) shall be kept on-site during construction.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

E. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized names.

F. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized names.

G. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized names.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:
1. Division 1 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 1 Section "Execution Requirements" for progress cleaning requirements.
4. Other Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service:
1. Owner's existing sewer system is available for use without metering but will be billed to Contractor for use charges.

C. Water Service:
1. Water from Owner's existing water system is available for use without metering but will be billed to Contractor for use charges. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service:
1. Electric power from Owner's existing system is available for use without metering but will be billed to Contractor for use charges. Provide connections and extensions of services as required for construction operations.

E. Sanitary Facilities:

1. Pay sanitary service use charge for temporary toilets, wash facilities, and drinking water for use of construction personnel.

1.4 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with 2019 CEC.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized steel bases for supporting posts.

B. Wind Screen Fabric: Green.

2.2 TEMPORARY FIELD OFFICES

A. Not required.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Install temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Install temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Install temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Install electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

H. Lighting: Install temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

B. Parking: Provide temporary or use designated areas of Owner's existing parking areas if approved for construction personnel.

C. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

D. Project Identification and Temporary Signs: Provide Project identification. Install signs where directed to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
   1. Provide temporary, directional signs for construction personnel and visitors.
   2. Maintain and touchup signs so they are legible at all times.
   3. Provide a 4'-0" x 8'-0" project sign constructed of 1/2 inch plywood or 10 mil corrugated mounted to 4"x4" posts 8'-0" long set 2'-0" deep into earth.
   4. Project sign shall include a graphic of the building (available from the Architect), Architect, Consultants, District, project, funding members with titles, and Contractor with contact information for the contractor. Text and layout shall be submitted for approval prior to installation.
   5. Location of project sign shall be coordinated with District’s representative.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

F. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Division 1 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
   1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations or as indicated on Drawings.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

F. Install full coverage with green wind screen fabric to block viewing through construction fencing. Wind screen fabric shall be anchored or weighted sufficiently to resist design wind loads indicated on Drawings.

G. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

J. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
   2. Construct dustproof partitions with 2 layers of 3-mil polyethylene sheet on each side. Cover floor with 2 layers of 3-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
      a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
   3. Insulate partitions to provide noise protection to occupied areas.
   4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
   5. Protect air-handling equipment.
   6. Weather strip openings.
   7. Provide walk-off mats at each entrance through temporary partition.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section includes general protection, pruning, and care of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.3 RELATED WORK SPECIFIED ELSEWHERE

Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.4 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured 12 inches above the ground for trees larger than 4-inch size.

B. Drip Line: The width of the canopy of the tree as measured by the lateral extent of the foliage on all sides.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Tree Preservation Schedule: Schedule, written by the arborist, detailing scope and extent of work to be performed to preserve and protect existing trees to remain that interfere with or are affected by construction.

1. Species and size of tree.

2. Location of tree on site plan. Include unique identifier for each.

3. Location of protection zone for each tree.

4. If arborist determines pruning is required, provide reason for pruning, description of pruning to be performed, and description of maintenance procedures following pruning.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

C. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.8 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by the International Society of Arboriculture (ISA) or a Registered Consulting Arborist as designated by ASCA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.9 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.

2. Storage or use of equipment and non-related construction activities, including pipe-cutting machines, tile-cutting machines, and lumber saws.

3. Storage or dumping of deleterious materials harmful to plant growth. Deleterious materials might include fuels, oils, other petroleum products, acids, liquids, concrete mix or concrete washout, stucco mix or stucco washout, paint or paint washout, and zinc grindings from working with galvanized products in the field.

4. Soil disturbance or grade change.

5. Moving or parking vehicles or equipment, even temporarily.

6. Foot traffic.

7. Erection of sheds or structures.

8. Drainage changes or impoundment of water.

9. Excavation or other digging unless otherwise indicated.

10. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

11. The use of a tree as a temporary power pole, backstop, winch support, anchorage, or other similar function.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Planting Soil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes.

B. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements. Previously used materials may be used when approved by District Construction Manager.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch-OD line posts, and 2-7/8-inch-OD corner and pull posts; with 0.177-inch-diameter top tension wire and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 72 inches.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, authored by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.

2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to District Construction Manager.

B. Maintain protection zones free of weeds and trash.

C. Maintain protection-zone fencing in good condition as acceptable to District Construction Manager and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Root pruning shall not be attempted by untrained construction personnel, but shall be performed by a qualified tree care professional or a certified tree care worker. Only personnel approved by the arborist shall perform pruning operations.

B. Prune tree roots that are affected by temporary and permanent construction. Prune roots as directed by the arborist or as follows. If direction from arborist is different from what is stated below, then direction from arborist governs.

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

2. Cut Ends: Treat as directed by arborist.

3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.

4. Cover exposed roots with burlap and water regularly.

5. Backfill as soon as possible according to requirements in Section 31 20 00 "Earth Moving."

C. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

D. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Crown pruning shall not be attempted by untrained construction personnel, but shall be performed by a qualified tree care professional or a certified tree care worker. Only personnel approved by the arborist shall perform pruning operations

B. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.

2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.

3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

   a. Type of Pruning: raising as directed by arborist.
   b. Specialty Pruning: Structural and/or utility as directed by arborist.

C. Unless otherwise directed by arborist and acceptable to District Construction Manager, do not cut tree leaders.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Do not paint or apply sealants to wounds.

F. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

G. Chip removed branches and dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 MAINTENANCE

A. Irrigation: If existing irrigation is turned off for any length of time, supplemental irrigation shall be applied to moisten the soil within the protection zone to the depth of the existing root system, typically in the top 2 to 3 feet of soil, and to then replace that moisture once it is depleted.

Irrigation frequency and depth shall be based on the needs of the individual tree. Irrigation applications performed on a schedule are not acceptable, as many variables determine the individual tree's needs (age of tree, size of tree, existing planting conditions (in turf), soil type, aspect, weather, time of year, extent of root pruning, etc). Light, frequent irrigation applications shall be avoided. Apply water deeply, thoroughly, and infrequently, by a method directed by the arborist. Water used in supplemental irrigation applications shall be clean potable water from a reliable source.

B. Where temporary clearance is needed for adjacent access, tree branches shall be temporarily tied back to hold them out of the clearance zone, with approval by the arborist. Tied branches shall be protected with burlap or other protective material to prevent wounding and chafing.

C. Dust Control: Tree shall be maintained in a clean fashion throughout the length of the Work. During periods of demolition, clearing & grubbing, grading activities, post-wind, or simply time, gently spray the foliage, trunks, and branches with clean potable water to remove construction dust. Do not utilize pressure washers, large streams of water with high volumes, or other insensitive methods to clean the foliage.

D. Area inside the tree protection zone shall be maintained in a neat manner, removing excessive leaf build-up, fallen twigs and branches, or debris deposited by winds or other causes.

E. When installing concrete adjacent to the tree protection zone, install a plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil.

F. Pest and Disease Control: Notify the arborist if any symptoms of pest or disease are observed. Provide appropriate measures to prevent or remedy pests and diseases, as directed by the arborist.

3.10 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by District Construction Manager.

1. Submit details of proposed pruning and repairs.

2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by District Construction Manager.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that District Construction Manager determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 10 inches or smaller in caliper size.

2. Large Trees: Project Arborist shall determine the tree appraisal value for damage and replacement using the most recent edition of the *Guide for Plant Appraisal*, authored by the Council of Tree and Landscape Appraisers (CTLA), and published by the International Society of Arboriculture (ISA), Champaign, IL. The formula used shall also be noted.

3. Plant and maintain new trees as specified in Section 32 93 00 "Plants."

C. Soil Aeration: Aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2 inch diameter holes a minimum of 12 inches deep at 24 inches o.c.. Backfill holes with an equal mix of augered soil and sand.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. General requirements for progress cleaning and waste disposal, including prohibition on burning waste materials on-site, are specified in Section 01 73 00 "Execution."

B. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off District property.

END OF SECTION 01 56 39

SECTION 015723 – TEMPORARY STORMWATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 PERFORMANCE

A. Minimum Water Quality Protection Requirements

1. The Contractor is required to meet the following minimum standards of good housekeeping:

a. Eroded sediments and other pollutants must be retained on site and may not be transported from the site via sheetflow, swales, area drains, natural drainage, or wind.

b. Stockpiles of earth and other construction-related materials must be protected from being transported from the site by wind or water.

c. Fuels, oils, solvents, and other toxic materials must be stored in accordance with their listing and are not to contaminate the soil nor the surface waters. All approved toxic storage containers are to be protected from the weather. Spills must be cleaned up immediately and disposed of in a proper manner. Spills may not be washed into the drainage system.

d. Excess or waste concrete may not be washed into the public way or any drainage system. Provisions shall be made to retain concrete wastes on-site until they can be appropriately disposed of or recycled.

e. Trash and construction-related solid wastes must be deposited into a covered receptacle to prevent contamination of rainwater and dispersal by wind.

f. Sediments and other materials may not be tracked from the site by vehicle traffic. The construction entrance roadways must be stabilized so as to inhibit sediments from being deposited into the public ways. Accidental depositions must be swept up immediately and may not be washed down by rain or by any other means.

B. Wet Weather Erosion Control Plan (WWECP)

1. The Contractor shall prepare a Wet Weather Erosion Control Plan (WWECP) and implement Best Management Practices (BMPs) necessary.

C. Stormwater Pollution Prevention Plan

1. The Contractor shall prepare applicable sections and comply with The Stormwater Pollution Prevention Plan (SWPPP). The Contractor shall complete and submit the Notice of Intent to construct under the California Construction General Permit (NPDES). The Contractor shall implement Best Management Practices (BMPs) necessary to control stormwater pollution from sediments, erosion, and construction materials leaving the construction site.

2. The BMPs contained in the Development Best Management Practices Handbook – Part A, Construction Activities cover the following categories of construction activities:
    a. Site preparation/earth removal
    b. Underground structures
    c. Aboveground structures
    d. Roadways, walkways and parking lots
    e. Planting and landscaping

3. The SWPPP document shall include the following information:
    a. The name, location, period of construction, and a brief description of the Project.
    b. Contact information for the Contractor, including name, address, and telephone number.
    c. Name, location, and description of any environmentally sensitive areas located on or adjoining the Project.
    d. A list of major construction materials, waste, and activities.
    e. A list of BMPs to be used to control pollutant discharges from major construction materials, wastes, and activities.
    f. A site plan (a construction plan may be used) indicating the location of BMPs where appropriate.
    g. A developer's certification statement that all required and selected BMPs will be effectively implemented.

4. Whenever the Contractor is required to get any type of permit from the Department of Building and Safety (DBAS), the Contractor shall submit the SWPPP document to the DBAS for review and approval before obtaining the permit. If the Contractor does not need any type of permit from the DBAS, the Contractor shall submit the SWPPP document to the Project Manager for review and approval. At least one copy of the approved SWPPP shall be kept at the construction site and accessible to City inspectors.

END OF SECTION 017420

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and product substitutions.

B. Related Sections include the following:
   1. Division 1 Section "References" for applicable industry standards for products specified.
   2. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Other Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: 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 the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Proposed products by manufacturers not listed in Manufacturers list.

C. Basis-of-Design: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating “or equal” products of other named manufacturers.

D. District Standard: Where a specific manufacturer's product is named and accompanied by the words "District Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics pre-selected by the District.
   1. District seeks to match products currently in use on other campuses; No substitution allowed.

1.3 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Generic name used in the Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.
      e. Supplier's name and address.
      f. Installer's name and address.
      g. Projected delivery date or time span of delivery period.
      h. Identification of items that require early submittal approval for scheduled delivery date.
   3. Completed List: Submit 3 copies of completed product list within days specified in General Conditions. Include a written explanation for omissions of data and for variations from Contract requirements.
   4. Architect's Action: Architect will respond in writing to Contractor within 21 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form provided at end of Section.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, environmental, and specific features and requirements indicated.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. 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.

3. Architect's Action: Architect will notify Contractor of acceptance or rejection of proposed substitution within 21 days of receipt of request.
   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. All substitutions affecting the Structural, Access or Fire-Life Safety portions of the project shall be submitted to DSA for approval as a Construction Change Directive in accordance with DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements.

D. The cost for any additional design or engineering required to gain DSA approval of a substitution shall be borne solely by the contractor. Any delay impacts resulting from DSA review and approval of substitutions shall be borne solely by the contractor.

E. Named Product and Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

F. District Standard Products Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Changes to the approved drawings and specifications shall be made by an addendum or a Construction Change Document approved by the Division of the State Architect, as required by Section 4-338, Part 1, Title 24, CCR.

B. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT 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.

B. Delivery and Handling:

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 an 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 the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to other sections for specific content requirements and particular requirements for submitting special warranties.

C. Warranty Period: Warranty period specified in each sections are minimum requirements. Do not modify manufacturer’s standard warranty period if the manufacturer’s warranty has longer warranty period.

D. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

B. Product Selection Procedures:
   1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
   3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
   5. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or an equal product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with “or equal”.
   6. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Product Substitutions" Article to obtain approval by Architect for use of an unnamed product.
   7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
      a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
   8. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
      a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or

texture from manufacturer's product line that does not include custom or premium items.

b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes standard, custom, and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 35 days after the Notice to Proceed**.** Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction and has paid any fees.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
11. Furnish samples upon requested by Architect.
12. Attached Request for Substitution Form shall used for substitution requests.

C. Substitutions for products or systems involving structural, fire/life safety and access compliance will be considered a Construction Change Document or Addendum, and will require DSA approval. This will add time required to review those substitutions requiring DSA approval. Contractor is solely responsible for all documentation and time required to obtain DSA approval.

1. The use of a product other than specified or noted on the Drawings will require the Contractor to get Engineer, Architect and DSA approval.
2. The Contractor shall be responsible to provide any information, calculations or drawings to show compliance with the DSA approved drawings and provide all documentation to the Architect and/or Engineer of record.
3. Any changes or “substitutions” that impact or relate to DSA requirements for structural, ADA or fire and life safety MUST be approved by DSA prior to proceeding with the work.
4. The Contractor shall also be responsible for all costs to the DSA, Architect or Architect consultants for review, co-ordination, and approval by the DSA.

a. All costs for submittal to DSA and Architect/ design team expenses shall be back charged to the Contractor.

PART 3 - EXECUTION

3.1 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Product List Form.
   2. Similar Installation List Form.
   3. Substitution Request Form.

END OF SECTION 016000

SUBSTITUTION REQUEST FORM

Substitutions are only allowed within number of days specified. Use this for m for requesting "or equal" products and materials.

Project:	Substitution Request Number:
	From:
To:	Date:
	Project Number:

Specification Section Title:		
Section Number:	Page:	Article/Paragraph:
Specified Item:		

Proposed Substitution:	
Manufacturer:	Address:
Contact Name:	Phone Number:
☐ Comparison between proposed substitution and specified product is attached. Note all differences.	

Reason for not using specified item:
☐ Specified product is no longer available.
☐ Substitution will improve lead time by _____ days
☐ Substitution will save Owner $ _____
☐ Other:

☐ List 3 similar installations including project name, address, owner, and date installed is attached.
Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explanation attached.

Supporting Data Attached:
☐ Product Data (indicate any options to be included)
☐ Drawings ☐ Test Reports ☐ Samples ☐ Color Chart ☐ Other:

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will not affect or delay Construction 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.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including architectural or engineering design, detailing, and construction costs caused by the requested substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

- Substitutions for products or systems involving structural, fire/life safety and access compliance will require AHJ approval. This will add time required to review those substitutions requiring AHJ approval. Contractor is solely responsible for all documentation, cost, and time required to obtain AHJ approval.

Submitted by:	Firm:
Signature:	Date:
Comments:	

A/E Review:
☐ Approve Substitution.
☐ Approve Substitution as Noted.
☐ Reject Substitution. Use specified product.
☐ Reject Substitution. Use specified product. Substitution request received too late.

Signed by:	Date:
Comments:	

Owner's Review and Action (Approval of substitution is not valid without Owner's signature)
☐ Substitution approved.
☐ Substitution approved as Noted.
☐ Substitution rejected. Use specified product.

Signed by:	Date:

Comments:

End of Substitution Request Form

PRODUCT LIST FORM

☐ Preliminary Product List.
☐ Complete Product List.
Include a written explanation for omissions of data and for variations from Contract requirements.

Project: ______________________________ From: ____

To: ______________________________ Date: ____

Spec Section		**Early approval?**	**Product**	**Model No.**	**Manufacturer**	**Supplier**	**Installer**	**Delivery Date**
No.	**Title**	☐ **Yes** ☐ **No**						

End of Product List Form

SIMILAR INSTALLATION LIST FORM

Provide minimum 5 similar installations within last 3 years.

Project: _____ From: _____

To: _____ Date: _____

	Date of Installation	Project Name	Owner Info	GC Info	Architect info
1					
2					
3					
4					
5					
6					
7					
8					

End of Similar Installation List Form

SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. General installation of products.
   2. Progress cleaning.
   3. Starting and adjusting.
   4. Protection of installed construction.
   5. Correction of the Work.

B. Related Sections include the following:
   1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   2. Division 1 Section "Submittal Procedures" for submitting surveys.
   3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
   1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas, and water-service piping; and underground electrical services.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

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

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Provide protection against weather, rain, wind, storms, frost and heat so as to maintain all work and materials free from injury or damage.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.7 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections include the following:
   1. Division 1 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work.

1.4 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. IOR's Inspection procedures.
   2. Warranties.
   3. Extra Materials.
   4. Final cleaning.
   5. DSA project closeout and Final Certification of Construction.

B. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
   2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
   3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   5. Division 1 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   6. Other Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 DEFINITIONS

A. IOR: Inspector of Record.

B. Inspection: IOR will inspect, not the Architect.

1.3 SUBMITTALS

A. Submit a copy of Title 24 Certificate of Acceptance forms submitted to enforcement agency.

1.4 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting IOR's inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. IOR’s Inspection: Submit a written request for IOR’s inspection for Substantial Completion. On receipt of request, Architect will either proceed with IOR’s inspection process or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after IOR’s inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.5 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final IOR’s inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. IOR’s Inspection: Submit a written request for final IOR’s inspection process for acceptance. On receipt of request, Architect will either proceed with IOR’s inspection process or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after

IOR's inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use form attached.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date specified in General Conditions.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Include Table of Contents.
3. Identify content with specification section number and title.
4. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
5. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

1.8 EXTRA MATERIALS

A. Deliver to Owner's facility manager extra materials specified in each section.

B. Organize submitted materials in orderly sequence based on the table of contents of the Project Manual.

1. Itemize each material and quantity in 8-1/2 by 11-inch paper.

C. Label each items for easy identification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting IOR's inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep concrete floors broom clean in unoccupied spaces.
      i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
      j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
      k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
   1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

3.2 DSA PROJECT CLOSEOUT AND FINAL CERTIFICATION OF CONSTRUCTION

A. Verified Reports: Per Title 24 Part1, Section 4-336.

B. Final Certificate of Construction: Per Title 24 Part1, Section 4-339.

C. Duties of Contractor: Per Title 24 Part1, Section 4-343.

3.3 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Punch-List Form.

END OF SECTION 017700

PUNCH-LIST FORM

☐ Preliminary Punch-List.
☐ Final Punch-List.

Project:	From:
To:	Date:

Item No.	Room No.	Area	Description	Completion Date	A/E Verification

End of Punch-List Form

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Maintenance manuals for the care and maintenance of products, materials, and finishes.

B. Related Sections include the following:
   1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
   4. Other Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.4 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.

6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product,

list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard printed maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 1 Section "Closeout Procedures" for general closeout procedures.
   2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Other Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit 1 set of marked-up Record Prints.

B. Record Specifications: Submit 1 copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit 1 copy of each Product Data submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.

5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
   4. Assemble in single binder with table of contents.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

3.2 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Record Product Data Form.

END OF SECTION 017839

RECORD PRODUCT DATA FORM

Record Product Data is due no later than 10 calendar days after the date of Substantial Completion. Photocopy for continuation sheets. List products in order by specification section numbers.

Project Name:	From:
To:	Date:

Spec Section		**Originally Specified**		**Actually Installed**	
No.	**Title**	**Model**	**Manufacturer**	**Model**	**Manufacturer**

End of Record Product Data Form

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:
   1. Division 1 Section "Project Management and Coordination" for requirements for preinstruction conferences.
   2. Other Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit 2 copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. At completion of training, submit 1 complete training manual(s) for Owner's use.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 031000-CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Completion of subgrade preparation, formwork, ties, shoring, bracing, anchorage and blockouts as indicated on the Drawings and specified herein.

B. Related Sections:

1. Curbs, Gutters, Sidewalks and Driveways; refer to Section 321313.
2. Concrete Reinforcing; refer to Section 032000.
3. Cast-in-Place Concrete; refer to Section 033000.
4. Rough Carpentry; refer to Section 061000.

1.2 REFERENCED STANDARDS

A. Refer to Section 014200 for information concerning availability and use of references.

ACI 117-10 - Tolerances for Concrete Construction & Materials

ACI 347R-14 - Formwork for Concrete

ANSI/AHA A135.4 - Basic Hardboard

ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous types)

CRD-C-572-74 - Polyvinyl chloride Waterstops

DOC PS-1-09 - Structural Plywood

WCLIB Std. No. 17. - Grading Rules for West Coast Lumber

WWPA - Western Lumber Grading Rules 2011 with Supplements

B. Conform to the requirements of Section 014000 – Quality Requirements.

C. Construct and erect formwork in accordance with ACI 318 and 347R.

D. Design forms and falsework to adequately support live and dead loads, including equipment, concrete drops, pressures of foundations, etc.

E. Follow recommendations of ACI 318 and 347R.

F. Title 24, Parts 1 and 2, California Building Code.

1.3 ARCHITECT'S REVIEW

A. Architect will review formwork for architectural suitability where exposed concrete finish occurs. Contractor shall be responsible for design of formwork for structural stability and sufficiency.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Earthen Forms: Provide earthen forms for footings only where the soil is firm and stable and the concrete will not be exposed, and subject to approval of the Division of the State Architect. Cut earthen forms square, neat and accurate to size. Clean bottoms of excavations.

B. Wood Forms: Provide wood forms**,** based on PS 1-09 Plywood or B-B Class I exterior, high density overlaid one side for forms, sound, undamaged, and clean, 5/8-inch thick minimum for exposed concrete work.

1. Lumber: Provide Douglas fir, construction grade lumber for framing, studding and bracing.

2. For site walls provide HDO or HDO 7 layer minimum grade B-B for all exposed walls.

C. Exposed Architectural Concrete: HDO or HDO B-B 7 Ply minimum for a smooth architectural finish. Seal all joints and edges.

2.2 COMPONENTS

A. Formed Construction Joints: Provide minimum 24 gage galvanized steel foam filled type, with release tape sealed slots, bent tab anchors, securable to formwork.

2.3 ACCESSORIES

A. Provide accessories and anchorages required, of sufficient strength, length and character to maintain formwork during pouring operations.

B. Use anchors and hangers which do not leave exposed metal at surface.

C. Use snap-off, removable, or adjustable type metal ties, hot-dip galvanized. Provide standard metal form clamp assembly, spreader type leaving no metal within 1 inch of concrete exposed face. Leave inner tie rod within concrete when forms are removed.

D. Provide colorless mineral oil type form coating, non-grain raising and non-staining type, Nox-Crete Company Nox-Crete Form Coating, or other approved equal.

E. Rigid foam plastic fillets may be used for chamfered corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencing work, inspect the work of others and verify that such work has been properly completed and installed to allow for proper installation of materials and methods required of this section.

B. Inspect forms in accordance with Title 24, Part 2, Section 1705A.3.5, California Building Code.

3.2 PREPARATION

A. Earthen Forms: Trench earthen forms at least two inches wider than footing widths shown on drawings. Construct wood edge strips at each side of trench at top to secure reinforcing and prevent trench from caving. Form sides of footings where earth caves. Tap form and clean debris and loose materials in earthen forms before depositing concrete.

B. Design of forms and shoring in excess of 3 feet in height, shall be by a California State registered Civil Engineer.

C. Verify accuracy of lines, levels, and centers.

D. All embedded items must be installed prior to placement of concrete - *NO EXCEPTIONS*.

3.3 APPLICATION

A. Construct formwork and appurtenances to meet design and code requirements. Construct of sound materials, of correct shape and dimensions, mortar tight, and of sufficient strength to prevent sagging, buckling, movement and failures. Provide adequate shores of wood or metal to safely carry imposed loads and adjustable to prevent displacements during the work.

B. Align joints and make them watertight.

C. Set reinforcing accurately and ensure secure placement.

D. Maintain tolerances of ACI 347R, within 1/8-inch in 10 feet and ¼" maximum deviation from theoretical dimensions. Exposed concrete may require tighter specifications.

E. Assist in setting and placing blockouts and sleeves for materials and products to be embedded in and passing through concrete.

F. Set screeds and establish levels for tops of concrete for finish surfaces. Shape surfaces as indicated on drawings.

G. Screed supports for concrete over waterproof membranes or vapor barriers shall be of a cradle, pad, or base type which will not puncture membrane.

H. Wet formwork prior to placing concrete and keep wet during concrete curing process.

3.4 PROTECTION

A. Do not remove formwork, shoring and bracing until such time as masonry and concrete has gained sufficient strength to carry its own weight, and construction and design loads which are liable to be imposed upon.

1. Verify strengths by compressive strength test results. Loosen forms carefully. Do not wedge pry bars, hammers or other tools against masonry and concrete surfaces.

B. In addition to ACI 318 Section 26.11.2, the following are minimum times for forms and shoring to remain in place prior to removal:

1. Footings and grade beams - 5 days.
2. Walls and columns - 14 days.
3. Beam sides - 10 days.
4. Beam and slab soffits - 28 days - Add temporary reshoring requirement.

END OF SECTION

SECTION 032000-CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Completion of reinforcing steel bars, welded wire fabric, support chairs, bolsters, bar supports and spacers as indicated on the drawings and specified herein.

B. Related Sections:

1. Curbs, Gutters, Sidewalks and Driveways; refer to Section 321313.
2. Concrete Forming and Accessories; refer to Section 031000.
3. Cast-in-Place Concrete; refer to Section 033000.

1.2 QUALITY ASSURANCE

A. Conform to the testing and inspection requirements of Section 014000 – Quality Requirements.

B. Perform reinforcing work in strict conformance with Chapter 19A, Title 24, California Building Code (CBC) 2022, and CRSI, 2018, unless specified otherwise or required otherwise by local code jurisdiction.

1.3 REFERENCES STANDARDS

A. Refer to Section 014200 – References for information concerning availability and use of references.

ACI SP-66(04) - Detailing Manual

ACI 318-14 - Building Code Requirements for Structural Concrete

ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A706 - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A1064 – Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

CRSI MSP, 29th Edition, 2018 - Manual of Standard Practice

AWS A5.1: 2012 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS A5.5: 2014 - Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding

AWS D1.4: 2018 - Structural Welding Code---Reinforcing Steel

B. In addition to CRSI specifications, follow ACI 315 and 318, AWS welding codes and

qualifications, and ASTM A1064, A615 and A706.

C. Testing of bars in accordance with Title 24, Section 1910A.2, Part 2.

1.4 TESTING

A. Comply with Title 24, Section 1910A.2

B. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number, and provided that the mill analysis accompany the report, then one tensile test and one bend test shall be made from a specimen from each 10 tons or fraction, of each size of reinforcing steel

C. Where positive identification of the heat number cannot be made or where random samples are to be taken, then one series of tests shall be made from each 2-1/2 tons or fraction, of each size of reinforcing steel.

D. Testing Laboratory shall perform chemical analysis of reinforcing for suitability for welding prior to welding. Welding reinforcing bars shall comply with ASTM A706.

1.5 SUBMITTALS

A. The Contractor shall be responsible for providing steel reinforcing as indicated on the Drawings for concrete reinforcing and as specified herein. Prepared Shop Drawings shall be reviewed by the Architect or Structural Engineer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not allow reinforcing materials to have direct contact with the ground. Cover materials adequately to prevent rusting, and contact with materials or construction injurious to proper bonding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: Deformed billet steel reinforcing bars, ASTM A615, plain finish (except ASTM A706 for welded bars where called for), see Drawings for grade.

1. When welding is required, provide reinforcing bars conforming to ASTM A706, including the additional requirements of AWS D1.4, as modified by 2022 CBC Standard Chapter 19A.

2. Where called for, provide ASTM A706.

2.2 ACCESSORIES

A. Welded Wire Fabric: Provide plain type, ASTM A1064, in coiled rolls, plain finished, void of rust, dust, scale, paint, grease and other coatings.

B. Provide minimum 16 gauge galvanized annealed tie wires, and chairs, bolsters, bar supports, and spacers sized and shaped for strength and support of reinforcing. Plastic

accessories may be acceptable if approved by Architect prior to use.

2.3 FABRICATION

A. Fabricate in accordance with details shown.

B. Accurately bend, cut and place bars as shown on Drawings and in accordance with the requirements of Title 24, Part 2, Section 1905A and ACI 318. Bend bars cold; heating of bars is not permissible. Do not bend or straighten bars in any manner that will injure materials.

C. Welding: Reinforcing to be welded shall comply with the requirements of Title 24, Part 2, Section 1903A.8 and ACI 318. Perform welding, where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using E80 series low hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during cooling process; accelerated cooling is prohibited. Do not tack weld bars. Clean metal surfaces to be welded of all loose scale and foreign materials. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds found defective, with chisel, and replace with proper welding.

1. Employ only experienced certified welding operators.

2. Prequalification of welds are to be in accordance with code and carbon equivalent of reinforcing not exceeding 0.75.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencing work of this section, inspect work of others and verify that such work has been properly completed and installed to allow for proper installation of all materials and methods required of this section.

3.2 INSTALLATION

A. Fabricate reinforcing in accordance with ACI 315. Locate reinforcing splices not shown on drawings, at points of least stress. Where shown or required, weld reinforcing bars in accordance with AWS D1.4.

B. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.

C. Ensure that reinforcing used is clean, free of scale, dirt, dust, rust and other matter.

D. Provide lap splices for bars noted as "cont.". Provide a Class “B” lap splice in concrete and 72 bar diameters in masonry. Wire all laps and splices in welded wire mesh and provide side and end laps of at least 6 inches.

1. Spacing - minimum center-to-center distance between parallel reinforcing bars is to be in compliance with that shown on drawings, or in the absence of such information on drawings, the clear spacing is to be one bar diameter, but in no case less than 1-1/2 inch, nor less than 1-1/3 times the maximum size of aggregate.

2. Where possible, stagger splices of adjacent vertical bars.

E. Only splice reinforcing where shown or noted. Splices at other locations must be approved by the Architect. Provide continuous reinforcement between splice locations in vertical walls. No splices of vertical wall reinforcing may occur except at foundations, unless specifically approved by Division of the State Architect, and the Architect.

1. Securely tie reinforcing with 16 gage tie wire at all splices and intersections, and as may be directed.

2. Point ends of wire ties away from forms.

F. Stagger splices in adjacent horizontal wall reinforcing bars a minimum of 4 feet.

G. Provide dowels in footings and/or grade beams the same size and number as vertical wall or column reinforcing. Provide a minimum dowel projection equal to Class “B” lap splices unless noted otherwise.

1. Securely tie dowels in place before depositing concrete. Install No. 3 bars for securing dowels where no other reinforcement is provided.

H. Provide the minimum coverage of reinforcing by concrete:

MINIMUM COVER:
Inches (mm)

1. Cast against and permanently exposed to earth…… 3 (76)

2. Concrete exposed to earth or weather……2 (51)

Walls and Curb……..… 1 1/2 (38)
Slab On Grade…….…….Center

3. Concrete not exposed to weather or in contact with ground:

Slab, walls, Joists…..…… 1-1/2 (38)

4. Beams & Columns:

Primary reinforcement, ties, stirrups, spirals…….1-1/2 (38)

I. Reinforcing bars shall not be re-bent.

3.3 APPLICATION

A. Correction during concreting: Maintain capable steel workers during placement of concrete for properly resetting reinforcement displaced by runways, workers, or other causes.

B. Reinforcement: As a minimum for slab reinforcement, provide 6 x 6 W4.0 x W4.0 wire mesh ASTM A1064, if no other reinforcement is indicated.

3.4 DEFECTIVE WORK

A. The following reinforcing work will be considered defective and may be ordered by Owner to be removed and replaced at no additional expense to Owner:

1. Bars with kinks or bends not shown on Drawings.
2. Bars injured due to bending or straightening.
3. Bars heated for bending.
4. Reinforcement not placed in accordance with Drawings or Specifications.
5. Rusty or oily reinforcement.

3.5 FIELD QUALITY CONTROL

A. Refer to Section 014000 - Quality Requirements.

B. Prior to pouring concrete, notify all parties to the inspections, that reinforcing is ready for inspections. Secure approvals by testing laboratory and inspector before concrete operations commence.

3.6 CURING

A. Concrete (other than high-early-strength) shall be maintained above 50 degrees F. and in a moist condition for at least the first seven (7) days after placement, except when cured in accordance with Section 26.5.3.2 (a), ACI 318.

END OF SECTION

SECTION 033000-CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Completion of sand bed, vapor barrier, cast-in-place concrete, and finishes as indicated on the drawings and specified herein.

B. Related Sections:

1. Curbs, Gutters, Sidewalks and Driveways; refer to Section 321313.

2. Concrete Forming and Accessories; refer to Section 031000.

3. Formwork, Earthen forms: See Section 031000 Concrete Forming and Accessories.

4. Concrete Reinforcing: See Section 032000.

5. Miscellaneous steel, see Section 051200 Structural Steel Framing.

1.2 QUALITY ASSURANCE/SUBMITTALS

A. Conform with the requirements of Section 014000 – Quality Requirements.

B. Perform concrete work in accordance with ACI 301 and 318, unless specified otherwise. Provide continuous inspection and testing for concrete placement in accordance with Sections 1705A.3 and 1905A Title 24, Part 2, California Building Code.

C. Sample Panels: When and where instructed to do so, provide on-site sample panel with specified finishes. Construct additional panels as may be necessary to gain approval of finishes desired. After rejection of panel, remove from site immediately. Approved and reviewed panel is to be left in place at site for project duration as a project standard.

D. Testing Laboratory Services:

1. Owner will employ and pay for an Independent Testing Laboratory to review the various concrete mixes required to produce concrete of the strengths required for the project. Submit and obtain approvals before proceeding with the work. Concrete mix shall be designed per ACI 318 Section 26.4.2.

2. Separately, Owner will employ and pay for a testing laboratory to perform tests and inspections, but the cost of subsequent and additional testing and inspections due to failed items will be backcharged to the Contractor.

E. Submit design mixes to Architect for Structural Engineer, and Testing Lab review and approval. Contractor shall pay for review of more than two (2) designs for each strength required.

F. Submit shrinkage test for each design minimum. Perform the following shrinkage tests

for concrete, for each 150 cubic yards and fraction:

1. Specimens - 4-inch x 4-inch and 11 inch long bars, cured for seven (7) days in a moist r oom an d as sp ecified i n A STM C 157. Mak e m easurements at 7 d ay intervals until 35 days of curing has elapsed.

2. Allowable shrinkage of lightweight concrete used on project is not to exceed 0.05 percent after the 35 days of curing has elapsed.

1.3 REFERENCE STANDARDS

A. Refer to Section 014000 – References for information concerning availability and use of references.

ACI 318 - Building Code Requirements for Structural Concrete and Commentary

ASTM C33 - Standard Specification for Concrete Aggregates

ASTM C94 - Standard Specification for Ready-Mixed Concrete

ASTM C114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement

ASTM C156 - Standard Test Method for Water Loss [from a Mortar Specimen] through Liquid Membrane-Forming Curing Compounds for Concrete

ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete

ASTM C227 - Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)

B. All work under this section shall be in accordance with applicable provisions of CBC, 2022, Title 24, Part 2, Chapter 19A.

C. Refer to the following information for compliance of materials, products, and installation techniques: ASTM C33, C94, C150, C260, C494 and ACI 301, 304R-00 and 3051-14.

D. Handling and Placing: Concrete transported and placed as per ACI 318. Concrete shall be thoroughly compacted and worked into forms around reinforcing steel using suitable equipment. Vibrating of formwork will not be permitted.

E. Where conditions make placing difficult or reinforcing is congested, batches containing the same proportions of sand and cement used in the concrete plus a maximum of 50 percent of coarse aggregate shall be used.

F. Inspections: Notify the Architect, Structural Engineer, and the Division of the State Architect (DSA) at least forty-eight hours in advance of the first pour of concrete and sufficiently in advance of subsequent pours, see 1704A, Title 24, Part 2, California Building Code and chapter 4, section 4-434(b), Title 24, Part 1, California Administrative Code.

G. Testing: The Inspector will take at least four cylinders of concrete from each day's run of

50 yards, or 2,000 sq. ft. of surface area for slabs, or fractional part thereof, per ACI 318. Field specimens of concrete taken and tested in accordance with 2022 CBC Standard. Label each cylinder with job name, date, number, result of slump test, and the point in the pour in the structure from which the sample was taken noted thereon. One cylinder shall be tested at seven days and two at 28 days. The fourth cylinder shall be stored for 56 days unless instructed otherwise. Core test to comply with ACI 318 if cylinder tests indicate deficiencies.

H. Embedded Items: Pipes and conduit in concrete, located, sized and if required, sleeved in accordance with the requirements of ACI 318. Bolts and anchorage devices embedded in concrete to fastened sills, tie-down columns and other structural and framing members to concrete installed and secured in place before concrete is placed.

1. Concrete shall be placed in a continuous operation between predetermined joint locations. Location of construction joints shall be as shown on the drawings or at locations approved by the Engineer and the Division of the State Architect.

2. Joints shall be straight, exactly horizontal or vertical and the surface of the concrete shall be level wherever a run is stopped. Reinforcement shall be extended through joints or dowels to develop the full strength of the reinforcement. Construction joints shall be per ACI 318.

1.4 TESTING

A. Provide free access to work. Provide laboratory design mix. No substitutions will be accepted. Cement and aggregates shall be tested.

B. Cement: Test Portland cement in accordance with Sections 1910A.1, Title 24, Part 2, and Section 26.4.1.1, ACI 318.

C. Batch Plant Inspection: Provide in accordance with Section 1705A.3.3, Title 24, Part 2.

D. Placing Record: Keep records of placing in accordance with Section 1705A.3.6, Title 24, Part 2.

E. Cylinder Test: Provide in accordance with Section 1905A.1.15, Title 24, Part 2.

F. Slump Test: Provide in accordance with ASTM C143 for each set of test cylinders.

G. Placing Inspection: Provide in accordance with ACI 318.

H. Moisture Testing: All slabs to receive flooring materials other than ceramic tile shall be calcium chloride dome tested at least 54 days after placement. Readings exceeding requirements of flooring manufacturer (generally 3 lbs. per 1,000 s.f. per 24 hours) will require retesting prior to installation of flooring. Readings in excess of 5 lbs. per 1000 s,f, will require testing by Owner using petrographic analysis to determine water/cement ratio at time of placement.

1. All tests in areas where concrete was placed with a water/cement ratio in excess of 0.45 will be paid for by Owner, but may be back charged to Contractor.

I. Compaction Testing: Provide in accordance with ASTM D689.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Provide ASTM C150 TYPE II conforming to requirements of 1903A.6, Title 24, Part 2. If aggregates contain reactive substances, reactive with cement alkalies they may not be used.

B. Aggregates:

1. Base and Aggregate base shall conform to the State of California, Department of Transportation (CALTRANS) Standard Specifications, Current Edition. All base, whether called out as aggregate base or base shall be in conformance with CALTRANS Section 26 for Class 2 Aggregate Base, 3/4-inch maximum. The maximum percentage of recycled material allowable shall not exceed 50% of the total volume of aggregate used.

2. Base and Aggregate Base shall be provided by a licensed commercial materials supplier. Certifications shall be submitted with each submittal. Use of on-site asphalt materials in aggregate base or base is strictly prohibited. The use of Crushed Miscellaneous Base is strictly prohibited.

3. Aggregates: ASTM C33, 1-inch maximum conforming to CBC 2022, Title 24, Part 2, 1903A.5 Aggregates and ACI 318.

C. Curing Materials:

1. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.

2. Moisture-Retaining Cover: One of the following, complying with ASTM C171:

a. Curing paper
b. Polyethylene film
c. Burlap Polyethylene-coated

3. Liquid Membrane-Forming Curing Compound: Liquid type non-wax membrane-forming curing compound complying with ASTM C309, Type I, Class B. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal/ product shall be compatible with finishes to be applied to concrete.

a. Products: Subject to compliance with requirements, provide one of the following:

"2000 Kure 1315"	BASF Building Systems.
"Kurez W Vox"	Euclid Chemical Co.
"Sealtight 1100-Clear"	W.R. Meadows, Inc.

b. Surface Treatment for Slabs Receiving Wood Flooring, Sheet Vinyl, or Resilient Flooring including Sheet vinyl and Vinyl Cementitious Tile, Carpet with a Vinyl, Rubber or Unitary Type Backing: Waterproof, Seal and Cure Application, CS 2000 by Creteseal (800) 278-4273, or equivalent, Floor Seal Technology, Inc. (800) 572-2344.

4. Warranty: 15 years Labor and Materials backed by a $1,000,000 Insurance Policy

a. A trained applicator shall apply CS 2000, or a technician must be on site during the spraying applications for verification to receive the 15 year warranty on floor coverings.

b. When a floor covering system is installed on a slab treated with the product according to manufacturer's instructions, the manufacturer shall warrant the floor covering system against delamination due to negative, ground originated moisture migration or moisture-born contaminates for a period of ten years from the date of original installation.

The warranty shall cover labor and materials necessary to repair or replace the floor covering system if repair cannot be made.

5. After pouring, placing, bullfloating, final finishing, soft cutting, and the surface of the concrete has hardened sufficiently to sustain foot traffic, CS 2000 Sealer shall be applied.

6. Apply CS 2000 Concrete Sealer at the rate of 200 square feet per gallon coverage. If puddling or bird bathing occurs, lightly broom product evenly over the substrate.

7. Continue brooming the product evenly over the substrate until the CS 2000 product has penetrated into the concrete.

8. Provide one of the following, or other approved equal:

Creteseal CS 2000.
Ashford Formula
Kure N Harden – By BASF

D. Water: Provide clean water conforming to ASTM C1602 free from injurious substances, per Section 26.4.1.3, ACI 318.

E. Vapor Barrier: Provide Stego Industries, 15-MIL Specifications, comply with ASTM E 1745, Class A, requirements.

F. Admixtures: *(No Calcium Chloride)* Admixtures to be used in concrete shall be subject to prior approval by the IOR and the Division of the State Architect, CBC 2022.

1. Water Reducing: Reduce water 5 percent minimum, increase 28 day

compressive strength, decrease 21 day drying shrinkage, ASTM C494.

2. Provide one of the following, or other approved:

BASF The Chemical Co. Pozzolith 300 R.

3. Acceleration or Retarding: ASTM C494.

4. Air Entraining: 4 percent minimum, 6 percent maximum air content by volume, ASTM C260.

5. Admixtures shall be in accordance with Section 26.4.1.4 ACI 318.

6. Concrete Sealer: Dayton Superior “Cure & Seal 309 J18”, W.R. Meadows "VOCOMP®-25", or Sonneborn® Products "Kure-N-Seal W" as manufactured by BASF.

a. For site walls use Sinak HLQ 125.
b. 3000 psi concrete 3/8” – 1/2” aggregate.

7. Non-Slip Surface: Trowel finish aluminum oxide grains, at exterior stairs and where indicated on the Drawings.

8. Add shrinkage reducing agent, such as “Eclipse®” as manufactured by Grace Construction Products or Peramin® SRA as manufactured by Peramin.

2.2 COMPONENTS

A. Non-Shrink Grout: Premixed compound consisting of non metallic aggregate, cement, water reducing and plasticizing agents, capable of developing non-shrink characteristics in both the horizontal and vertical direction with minimum compressive strength of 4,800 p.s.i. in two (2) days, and 6,000 p.s.i. in twenty-eight (28) days.

1. Provide Embeco Grout as manufactured by BASF, or other approved by Five Star, Dayton Superior, or Sika.

B. Cement Grout and Drypack: Precision support grout shall be BASF Masterflow® 713 Grout as manufactured by Master Builders, Cleveland, Ohio consisting of a hydraulic cementitious system, specially graded and processed natural fine aggregate and additional technical components. Other products will only be acceptable providing written approval of the Engineer is obtained prior to bidding. Acceptance will be granted only upon satisfactory evidence proving that the substitute material meets the following requirements, conforming to CRD C-621 Corps of Engineers.

1. Free of gas producing or releasing agents.

2. Free of oxidizing catalysts.

3. Free of inorganic accelerators, including chlorides.

4. Drypack: Pre-mixed grout shall be used. Use only enough water to make a stiff mix consistency. Pre-mixed grout shall be used under base plates per manufacturer's recommendations, and packed solid under pressure treated mudsills, per Structural Details, so as to obtain a continuous bearing. Minimum compressive strength of 6000psi.

C. Joint Materials: Provide tooled joints or plastic control joints.

1. Construction Joints: Provide metal keyed dividers for cold joints, subject to review and approval by Architect.

2. Expansion Joint Fillers:

a. 1/2-inch asphalt impregnated fiber conforming to ASTM D545 Type 5, where slab abutts wall or other vertical elements.

b. Where joint will be finished with sealant, set expansion strip with a 1/2-inch deep removable expansion strip cap.

D. Under Slab Vapor Barrier: 15 mil Stego Wrap, Fortifiber Building Systems, or W.R. Meadows, or equal, over 2” compacted sand. Refer to plans and Geotechnical Report for installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Certifications: Provide legible copies of the delivery tickets of each load of concrete with the following information:

1. Name and location of plant.
2. Serial number of ticket.
3. Date and truck number.
4. Name of contractor.
5. Name of project.
6. Type of class of concrete and how to be used.
7. Amount of concrete.
8. Time loaded, time of arriving and unloading at project site.
9. Water added at site and total water content.
10. Type, name and amount of admixtures.
11. Name and signature of person making slump tests.
12. Testing number of test cylinders.

3.2 PREPARATION FOR PLACEMENT

A. Remove foreign debris and matter which may have accumulated within forms, and close ports and openings left in formwork.

B. Thoroughly clean tools used in transportation, placing and consolidating concrete

immediately after each pour.

C. Ensure that required inspections have taken place prior to pour.

3.3 APPLICATION

A. Mixes: The minimum concrete ultimate twenty-eight (28) day compressive strength to be per structural drawings and shall be controlled by the following method:

1. Designed Mix: Concrete mixes shall be based upon previously proven mixes and material tests made by a recognized testing agency. The design of such mixes shall be based on the ultimate strength of the concrete assumed in the design of the structure and shall take into consideration both the workability of the mix and the durability of the concrete. Refer to Sections 1903A and ACI 318.

2. When strengths in excess of 3,000 pounds per square inch are required, or special aggregates not having a record of satisfactory performance are used, or admixtures are used to reduce the cement content, ACI 318, shall be used to determine the mix.

3. Where design criteria in Title 24, Part 2, chapter 19A and ACI 318, provide for the use of a splitting tensile strength value of concrete as a modifier, laboratory tests shall be made in accordance with the CBC to establish the value of fct corresponding to the specified value of f'c.

4. Tensile-splitting tests of field concrete shall not be used as a basis for acceptance.

5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement not less than 1 inch and not more than 4 inches.

6. The maximum water to cement ratio shall not exceed 0.5 (50%).

7. Project specific shrinkage test. Perform test using actual proposed mix with some aggregates used in the project. Limit 28-Day shrinkage to 0.045 percent.

B. Control Density Fill: Provide batch plant design mix of 4000 p.s.i., flowable concrete composed of 3000 lbs aggregate, 45 gals water, 50 lbs of cement and 400 lbs of flyash. Adjust proportions for materials as necessary and submit to Architect, for information.

3.4 CONVEYING

A. Handle concrete from mixer to location of placing as rapidly as practical, avoiding separation or loss of ingredients and rehandling. Use carts, wheelbarrows, concrete pumps, conveyors or buggies to deliver concrete to location of placement.

B. Do not permit a free fall of more than 4 feet when placing concrete.

C. Use elephant trunk spouts for placing concrete in vertical elements. Space so that concrete does not exceed 4 foot flow horizontally.

3.5 PLACEMENT

A. In general, place concrete in accordance with ACI 301, and in the presence of the inspecting personnel required.

B. Ensure that anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause hardship in placing concrete.

C. Maintain records of poured concrete. Record date, location, quantity, air temperatures, and test samples taken.

D. Ensure that reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

E. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.

F. Pour concrete continuously between predetermined construction, control and expansion joints. Pour in a checkerboard pattern, unless otherwise directed.

G. Excessive honeycomb and embedded debris is not acceptable.

H. Conform to ACI 305.1-14 when concreting in hot weather.

I. Install vapor barrier in widest widths possible, under interior slabs on grade. Place at center of 4 inches of sand (minimum of 2 inches of sand top and bottom) lapping joints at least 18 inches and sealing joints, taping pipe penetrations.

J. Screed slabs and concrete bases level to a tolerance of 1/8-inch in 10 feet. Vary slab thickness as required to maintain top of slab elevation as design. Maintain top of slab elevation within ± 3/8” of intended elevation. Continually survey top of concrete elevations during concrete pour.

K. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections.

L. Modify or replace concrete not conforming to required lines, details, shapes and elevations. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of Architect.

M. Provide smooth rubbed finish on concrete surfaces to be left exposed such as concrete walls, columns, beams, and joists, except as otherwise indicated.

N. Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete. Moisture cure for seven (7) days minimum all interior slabs.

O. Drypack shall be packed solid under baseplates and thoroughly packed under pressure treated mudsills, per Structural Details, so as to obtain a continuous bearing.

3.6 CONSTRUCTION JOINTS

A. Provide construction joints in slabs in accordance with ACI 318.

1. For slabs-on-grade, place control joints at 15 feet maximum on center in each direction, unless shown otherwise on Drawings.

B. The surface of horizontal construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix, in accordance with the following procedure:

The contact surface shall be thoroughly cleaned by chipping or sand-blasting the entire surface not earlier than 5 days after initial pour, or by an approved method that will assure equal bond, such as a thorough hose-washing of the surface not less than two or more than four hours after the concrete is placed (depending on setting time), wash water and chalk-like material being entirely cleaned from the surface.

In the event that the contact surface becomes coated with earth, sawdust, etc. after being cleaned, the entire surface so coated shall be re-cleaned.

A mix containing the same proportion of sand and cement used in the concrete, plus a maximum of 50 percent of the coarse aggregate, shall be placed on horizontal joints before proceeding with the regular specified mix. A delay at least until the concrete in columns and walls is no longer plastic must occur before casting or erecting beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor system, and shall be placed monolithically therewith.

3.7 FIELD QUALITY CONTROL

A. Testing: Comply with CBC, 2022, Title 24, Part 2, Section 1903A.

B. If compressive strength tests of cylinder specimens fail to show strengths assumed in design, take 4 inch diameter cores at representative locations throughout structure as designated by Inspector. Take cores in accordance with ASTM C42. The strength level of the concrete shall be considered satisfactory if the average strengths of the area or panel equals or exceed the specified strength at 28 days, with no individual strength test of such area or panel less than 5 percent below that specified. Concrete that does not meet or exceed these criteria shall be removed by the contractor and replaced with concrete that conforms to these criteria. Remove and replace defective concrete at no additional cost to Owner. Be financially responsible for repair and replacement of other in-place materials affected by such removal and replacement.

Costs of taking core samples and performing tests required will be paid by Owner if tests prove satisfactory. If test fail to show required strengths, concrete contractor will be held financially responsible.

C. If the strength of the molded test cylinder falls below the minimum ultimate compressive strength assumed in the design, adjust the proportions of the mix for the remaining portion of the structure to give concrete of the assumed minimum strength.

D. Concrete will also be deemed defective which is not formed properly as indicated, is not true to intended alignment, is not plumb or level where so intended, is not true to intended grades, has sawdust or other debris embedded within it, or does not fully conform to other provisions of these specifications. As directed, remove and replace with concrete complying with these specifications.

3.8 CONCRETE FINISHES

A. Slab Levels: Surfaces shall finish true to 1/8-inch in 10 feet on a straight-edge and in direction with maximum high and low variance occurring in not less than 20 feet and with 1/16-inch maximum tolerance in one running foot. Particular care shall be taken to finish troweling around the edges of the slabs so finish surface edges shall be at same elevations as the rest of the top surface of the slab. Slabs shall be surveyed continuously during pour.

B. Concrete Sealer: Concrete floors not indicated in the schedule to receive other finish shall receive two coats of sealer specified this section. Concrete to receive sealer shall be cured with specified concrete sealer that functions also as cure. Use the same material for each application.

C. Steel Trowel Finish: Interior slabs shall receive a monolithic steel trowel finish. Surfaces shall be screeded, wood floated, and steel-troweled. Finish shall be a smooth, hard, dense, impervious surface, free of defects. Finishers shall work from knee boards laid flat upon the surface. Mechanical troweling machines may be used if the desired finish and level tolerances can be obtained by their use, but finishing shall be by hand troweling.

1. Slabs to receive tile, carpet or adhered finishes shall receive light/medium broom finish to create "tooth" for adhesive.

2. Unfinished exposed to view slabs in service closets, mechanical, electrical, stairs, ramps, and similar spaces shall receive a medium/heavy broom finish. See Section 32 16 00 for site flatwork.

D. Depressed slabs shall be finished by tamping slab with an open grid tamper, screeding with a straightedge and wood floating to a true and uniform surface, true to tolerance of 1/4-inches in 10 feet.

3.9 CONCRETE CURING AND PROTECTION

A. General: At slabs that do not receive concrete sealer, per 2.01D, provide the following: Concrete Curing per Section 26.5.3, ACI 318. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Concrete shall be maintained above 50 degrees and continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301

procedures. Avoid rapid drying at end of final curing period.

B. Slab Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover during, and by combinations thereof, as herein specified. Provide Moisture-Curing by the following Methods:

1. Keep concrete surface continuously wet by covering with water. Continuous water-fog spray, for seven (7) days minimum.

2. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof type of adhesive. Immediately repair holes or tears during curing period using cover material and waterproof tape, for seven (7) days minimum.

3. Provide Curing and Sealing Compound to exterior slabs, walks, and curbs, as follows:

   a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application.

   b. Maintain continuity of coating and repair damage during curing period.

   c. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, such as liquid floor hardener, waterproofing, damp proofing, membrane roofing, ceramic or quarry tile, vinyl composition tile (VCT), glue-down carpet, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

   d. Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

4. Curing Unformed Surfaces:

   a. Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of moisture curing method.

   b. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

5. Sealer and Dustproofer: Apply two (2) coats of specified curing and sealing compound to Interior slab surfaces not receiving any other finish.

6. Concrete (other than high-early-strength) shall be maintained above 50 degrees F. and in a moist condition for at least the first seven (7) days after placement,

except when cured in accordance with Section 26.5.3, ACI 318.

3.10 PROTECTION

A. Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Exposed Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

1. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

2. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

3. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled.

C. Concrete Surface Repairs: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repair of Formed Surfaces:

1. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

2. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

E. Repair of Unformed Surfaces:

1. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

2. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

3. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

4. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

5. Site walls: Remove cracked, honeycombed or defective concrete as required by the Architect from joint to joint. Patching, calking, filling or repairing will not be permitted.

F. Repair Defective Areas:

1. Repair defective areas, except random cracks and single holes not exceeding 1 inch diameter, by cutting-out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance around.

2. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

3. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72

hours.

4. Site walls: Remove cracked, honeycombed or defective concrete as required by the Architect from joint to joint. Patching, calking, filling or repairing will not be permitted

5. Perform structural repairs with prior approval of Architect of Structural Engineer for method and procedure, using specified epoxy adhesive and pressure grouting.

6. Repair method not specified above may be used, subject to acceptance of Architect.

G. Mitigation of Unacceptable High Moisture Emission Levels: Interior slabs-on-grade tested at levels in excess of 5.0 lbs/1000 s.f. shall be further evaluated with additional calcium chloride tests. Once levels are established, additional preparation measures shall be employed (depending on the magnitude of moisture levels) using one or both of the following products:

2 coats of Super-Krete
2 coats of Rust-Oleum 6000 system.

END OF SECTION

SECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brick.
   2. Mortar and grout.
   3. Ties and anchors.
   4. Embedded flashing.
   5. Miscellaneous masonry accessories.

B. Related Sections:
   1. Division 6 Section “Sheathing” for exterior sheathing and weather resistive barrier.

1.2 SUBMITTALS

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

B. Samples for Initial Selection:
   1. Brick, in the form of straps of five or more bricks.
   2. Colored mortar.

C. Samples for Verification: For each type and color of the following:
   1. Brick, in the form of straps of five or more bricks.
   2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   3. Accessories embedded in masonry.

D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

E. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C 67.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.

5. Anchors, ties, and metal accessories.

1.3 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Masonry Standard: Comply with TMS 402/602 unless modified by requirements in the Contract Documents.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Brick:
1. HC Muddox. (Basis of Design)
2. Pacific Clay.
3. Interstate Brick.
4. Arto.
5. Or equal.

B. Ties and Anchors:
1. Halfen. (Basis of Design)
2. Dayton Superior Corporation, Dur-O-Wal Division.
3. Heckmann Building Products Inc.
4. Hohmann & Barnard, Inc.
5. Wire-Bond.
6. Or equal.

C. Mortar Dropping Collection Device:
1. MortarNet. (Basis of Design)
2. Or equal.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Bricks: Comply with ASTM C62.
   1. Grade: SW.
   2. Type: FBS.
   3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
   4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   5. Size and Color: As indicated on Drawings.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91.

E. Mortar Cement: ASTM C 1329.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
   1. Sika Grout Aid or equal.

I. Mortar Dropping Collection Device:
   1. Product: Mortarnet with insect barrier by MortarNet or equal.
      a. Description: MortarNet helps prevent moisture damage to masonry cavity walls by preventing mortar droppings from blocking the weep holes and by providing hundreds of clear drainage pathways that allow moisture to flow to the weeps. Its open mesh also allows air movement to help equalize pressure and dry the cavity.

2.5 WEATHER RESISTIVE BARRIER

A. As specified in Division 6 Section “Sheathing”.

2.6 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951.

B. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 641, Class 1 coating.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
   2. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.

E. Product: HFA Fleming Anchor by Halfen or equal.
   1. City Of Los Angeles Research Report: RR-24560
   2. Anchors shall have 9 gauge galvanized wire in the grout line. Clip shall be positively capture 9 gage wire.

3. Description: Used to restrain the exterior width of masonry veneer walls against positive and negative wind loads and seismic forces.
4. The system has three elements:
   a. Fleming Anchor Channels secured to wall construction
   b. Anchors with one end inserted into the Channel and the other end embedded into the horizontal mortar bed between courses of masonry Strands of reinforcing wire in the horizontal mortar joint Fleming Anchor Channels are profiles 1" x 21/32" with inturned lips roll formed from 22 gage) pre-galvanized steel strip. Mounting holes are prepunched at 12" spacings. The channels are available in bundles of 50 pieces each 10'-0" in length.
   c. Anchors are T-shaped and are stamped from 14 gage thick pre-galvanized steel strip, complete with central stiffening rib and two tabs.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Stainless Steel: ASTM A 240, Type 304, 0.016 inch thick.
   2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
   3. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   4. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

E. Install two layers of weather resistive barrier over sheathing.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch; do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   3. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets.

Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: As indicated on Drawings.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with seismic masonry-veneer anchors to comply with manufacturer’s written instructions.
1. Installation shall comply with TMS 402, Section 12.2.2.11.2 for Seismic Design Category D.

3.7 EXPANSION JOINTS

A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.8 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
   6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
   7. Clean stone trim to comply with stone supplier's written instructions.
   8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."
   9. Low Pressure Application:
      a. Lightly pre-wet or flash-cool the surface (do not soak).
      b. Apply NMD 80 through an EC Jet to the entire section to be cleaned.
      c. After the initial application of chemical, scrape the large chunks with a long handled scraper from the first 8 feet of the wall.
      d. Check smears and tags to see if the crumble easily.
      e. If needed, repeat application to melt remaining residue and extend dwell time. If there is no foaming, the residue is ready to be rinsed.
      f. With NMD 80, the longer it stays on the wall, the cleaner the result and the least amount of rinsing is required. After re-application, scraping can be done further down the wall.
      g. Begin rinsing from top down. Use long even strokes that overlap each other.

END OF SECTION 042113

SECTION 042200 CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Pre-faced concrete masonry units.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Miscellaneous masonry accessories.
8. Masonry-cell fill.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for dovetail slots for masonry anchors, and concrete lintels at masonry construction.
2. Section 042300 “Glass Unit Masonry”.
3. Section 042613 “Masonry Veneer”.
4. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
5. Section 071900 "Water Repellents" for water repellents applied to unit masonry assemblies.
6. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

C. Samples for Verification: For each type and color of the following:

1. Exposed and Decorative CMUs.
2. Pre-faced CMUs.
3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.6 INFORMATIONAL SUBMITTALS

A. Material Test Reports: Signed by manufacturers certifying that each of the following items complies with requirements indicated:

1. Each type of masonry unit required.
2. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellant used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 402/602-16.

E. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Build sample panels facing south.
3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by the District Project Manager in writing.

    a. Where sample panels contain deviations from the Contract Documents, approval of sample panels does not constitute approval of deviations unless District Project Manager specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602-16. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg. F, or 90 deg. F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48-inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 402/602-16. except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi .
2. Density Classification: Medium weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8-inch less-than-nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

C. Decorative CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
4. Pattern and Texture:

a. Standard pattern, ground-face finish.[Match Architect's samples.]
b. Standard pattern, split-face finish.[Match Architect's samples.]
c. Standard pattern, split-ribbed finish.[Match Architect's samples.]
d. Scored vertically so units laid in running bond appear as square units laid in stacked bond, standard finish.[Match Architect's samples.]
e. Triple scored vertically so units laid in running bond appear as vertical units laid in stacked bond (soldier courses), standard finish.[Match Architect's samples.]

5. Colors: Match Architect's samples Retain "Special Aggregate" Subparagraph below if special aggregate is required to match sample.
6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

D. Pre-faced CMUs: Lightweight hollow concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
2. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with pre-faced surfaces having 1/16-inch-wide returns of facing to create 1/4-inch-wide mortar joints with modular coursing.
3. Colors and Patterns: Match Architect's samples.

2.4 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars

placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Davis Colors.
b. Lanxess Corporation.
c. Solomon Colors, Inc.
d. Or Equal.

E. Colored Cement Products: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Essroc.
2) Lafarge North America Inc.
3) Lehigh Hanson; Heidelberg Cement Group.
4) Or Equal.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of Portland cement by weight.
4. If pigments containing carbon black are used, carbon black must be limited to 2 percent of Portland cement by weight.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

I. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch-diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch-thick steel sheet, galvanized after fabrication.

    a. 0.064-inch thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie made from 0.25-inch-diameter, hot-dip galvanized steel wire.
3. Corrugated-Metal Ties: Metal strips not less than 7/8-inch wide with corrugations having a wavelength of 0.3- to 0.5-inch and an amplitude of 0.06- to 0.10-inch made from 0.060-inch-thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

    a. 0.064-inch thick, galvanized sheet may be used at interior walls unless otherwise indicated.

E. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4-inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and Section 07 62 00 "Sheet Metal Flashing and Trim".

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287,

Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.
5. For interior nonload-bearing partitions, Type S may be used instead of Type N.
6. Provide minimum 28-day compressive strength as indicated on drawings.
7. Limit cementitious materials in mortar to Portland cement and lime.
8. Mortar unused for 1-1/2 hours from initial mix time shall not be used.

C. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of Portland cement by weight.
2. If pigments containing carbon black are used, carbon black must be limited to 2 percent of Portland cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

    a. Decorative CMUs.
    b. Pre-faced CMUs.
    c. Where indicated.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

    a. Decorative CMUs.
    b. Pre-faced CMUs.
    c. Where indicated.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602-16 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1. Application: Use epoxy pointing mortar for exposed mortar joints with pre-faced CMUs.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. PROSOCO, Inc.
d. Or Equal.

B. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetasodium poluphosphate and 1/2-cup dry measure laundry detergent dissolved in 1-gal. of water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

E. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2-inch or minus 1/4-inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2-inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16-inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar, including starting course on footings.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4-inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than [**1/2-inch**] [**1-inch**] [**2 inches**] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

3.8 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

1. Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 402/602-16.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 402/602-16 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches unless noted otherwise in DSA IR**.**

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: The District will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

3.11 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4-inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8-inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain District Construction Manager’s approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be recycled, and other masonry waste, and legally dispose of off District's property.

END OF SECTION 042200

SECTION 051200-STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Furnish and Installation of structural framing members, complete in place with required bracing, weld washers, nuts, shims, anchor bolts, and baseplates as indicated on the Drawings and specified herein.

B. Related Sections: Metal Fabrications; refer to Section 055000.

1.2 REFERENCE STANDARDS

A. Refer to the following for information regarding materials and installation methods necessary:

1. California Building Code (CBC) 2022, Chapters 22A and 35, as adopted by Title 24, and Chapter 7, Section 704 Fire-Resistance Ratings of Structural Members.

a. Refer to Drawings for details, design numbers, and ratings.

2. On-Site Welding Requirements, Sections 2204A, 1704A and 1705A, Title 24, Part 2, California Building Code, 2019.

3. American Society for Testing and Materials: Specifications A36, A123, A307, A370, A500 and A992.

4. American Institute of Steel Construction (AISC).

5. American Welding Society: AWS D1.1 and AWS D1.4

6. Steel Structures Painting Council (SSPC).

1.3 SUBMITTALS

A. Submit Shop and Erection Drawings Prior to Fabrication: Prepare erection drawings by State registered Structural Engineer. Show welded connections, lengths of welds, profiles, sizes, spacing and locations of members, attachments, anchorages, framed openings, size and type of fasteners, cambers and live loads. Contractor shall be responsible for reviewing and verifying all dimensions on shop Drawings.

1. Splices and Deviations: Splices will be permitted only where and as shown on Drawings. Deviations from design drawings desired or required by fabricator are to be indicated on shop drawings by providing a heavy line around the feature on which deviation approval is being requested, showing complete detail and describing deviation proposed. Provide detail with a note specifically requesting approval of deviation by fabricator. Deviations or changes shall not be made without the approval of the Division of the State Architect, as a Change Order.

a. Refer to Section 013300 – Submittal Procedures, Paragraph 3.4 A.2. (Revisions) Cost of such changes shall be borne by the Contractor.

B. Erection and Bracing Plan and Procedure: Refer to Section 2205A, Title 24, Part 2, California Building Code. Employ a California State licensed Structural Engineer to prepare erection and bracing plan and erection procedure for structural steel including columns, beams, and girders, who will be responsible for compliance. Follow plan and procedure exactly. Maintain a copy at project site. Pay for costs involved.

C. Scrap collection and recycling plan: Contractor shall prepare and submit a scrap collection and recycling plan for all miscellaneous and structural steel.

1.4 QUALITY ASSURANCE

A. Tests and Inspections: Testing for steel shall be done in accordance with Title 24, Part 2, Section 1705A.2. Inspection shall be in accordance with Title 24, Part 2, Section Table 1705A.2.1.

B. If structural steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports (identified stock shall not be tested), testing shall be in accordance with Title 24, Part 2, Section 2202A.1

C. If structural steel cannot be identified or its source is questionable, make not less than one tension and one bend test for each 5 tons or fraction thereof. Also, it shall be tested to meet minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.

D. Furnish test specimens from steel fabricator and take them under the direction of the Testing Agency. Machine each test specimen by Testing Agency to dimensions required by ASTM A370.

E. Have testing agency pick up test specimens and make required tests.

F. Costs of tests of identified stock will be paid for by Owner, unless tests fail to comply with the specifications, in which case the Owner will pay for testing, but back charge the Contractor. Costs of tests for unidentified stock will be paid for by the contractor.

G. Complete a 4-sided inspection of steel. Such inspection shall be paid for by the Owner. The Inspector of structural steel which is not fabricated within 25 miles of the project site, shall also be paid for by the Owner, but the Contractor shall pay for travel expenses.

H. After fabrication and inspection, costs associated with re-inspection of defective or replaced materials shall be paid for by the Owner, but backcharged to the Contractor.

I. Provide labor, equipment and facilities necessary for moving and handling materials to be inspected.

J. Provide and pay for supervision by a registered Inspector of welding operations of frames with joints, including inspection for quality, penetration, and conformity of Drawings, and a report verifying that welding is adequate and was done in conformity of project

requirements.

1. Visually inspect welds, and have inspector present to approve welding and high strength bolting whether performed in fabricator's shop or at project site, and inspect erection. Ensure testing laboratory compliance with regulations of the Division of the State Architect and certify in writing, upon completion of work, that welding and high strength bolting has been performed in accordance with Drawings and these Specifications. Inspect grouting of column base plates.

2. ~~Have testing laboratory check bolt tightness on not less than 10 percent of bolts selected at random in each high strength bolt connection. Follow procedures of ASTM A325 and A490.~~

3. Submit all preliminary, working and final documents required by subsection 1.04K.

4. Inspect all seam welds at HSS steel member.

K. Comply with California Building Code (CBC) Title 24, Part 2, Sections 2213A and 1705A.2.

L. Results of tests, together with identified copies of the Mill Analysis and inspection reports shall be submitted to the Division of the State Architect, and to the Architect and Structural Engineer. Arrange for continuous inspection of Shop and field welding in accordance with Title 24, Part 2 Section 1705A.2.5 and Table 1705A.2.1.

1.5 PROJECT CONDITIONS

A. Verify measurements, lines, grades, locations and details at project site. Conform to existing field conditions.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Structural Steel Members: Shall conform to the requirements of ASTM A6, add the following sentence “and shall be fabricated according to AISC Practice and Specifications for Building.”

B. Structural plates, bars, etc., shall conform to ASTM A36. Structural wide flange beams and columns shall conform to ASTM A992, Grade 50.

C. Pipe columns shall conform to ASTM A53, Grade B

D. Tube members shall conform to ASTM A500, Grade B.

E. All welding shall be done using the shielded electric arc process by AWS certified welders using AWS A5.1, E70XX electrodes.

F. All welds used in primary members and connections in the lateral force systems shall be

made with a filler metal that has a minimum Charpy V-notch toughness of 20 ft.-lbs. at minus 20 degrees F., as determined by AWS classification.

G. Continuous inspection is required for all field and shop welding by an Inspector approved by the Division of the State Architect.

H. Bolts shall conform to ASTM A307, unless noted otherwise.

I. Structural Steel Shop Drawings shall be reviewed by the Structural Engineer prior to fabrication.

J. Light gauge steel members shall conform to ASTM A653, Grade A.

K. Recycled Content – Provide products with an average recycled content of steel so postconsumer recycled content plus one-half of postconsumer content is not less than 50%

2.2 LIGHT STRUCTURAL STEEL

A. Standard specifications for Hot-Formed Welded and seamless Carbon Steel Structural Tubing, ASTM A500 Grade B.

2.3 WELDING ELECTRODES

A. Conform to AWS, D1.1/D1.1M-15.

1. Required strength of weld shall comply with CBC Title 24, Part 2, Sections 2212A.2.3 and 2213A.

2.4 GALVANIZING

Galvanize all structural steel exposed to weather, unless otherwise noted on plans.

A. Provide hot-dip galvanizing in accordance with ASTM A123, Grade 90.

B. Field Galvanizing: Provide ZRC, or other approved.

2.5 PRIMER

A. Exterior Primer - Provide Tnemec Series 10, a zinc-chromate, or other approved. Primer shall have a VOC content of 100 g/l (0.83 lb/gal) or less when calculated according to 40 CRF 59, Subpart D (EPA method 24).

B. Interior Primer – Provide interior primer 734149X red oxide by Rodda Paint Co., or equal. Primer shall have a VOC content of 100 g/l (0.83 lb/gal) or less when calculated according to 40 CRF 59, Subpart D (EPA method 24).

C. Clean, prepare and shop prime exterior members in accordance with SSPC-Paint 20 or SSPC-Paint 29 and compatible with top coats indicated on plans. Do not prime specific

surfaces to be welded or which will be in direct contact with concrete or other cementitious materials.

D. Clean, prepare and shop prime interior members in accordance with SSPC-Paint 23 and compatible with top coats indicated on plans. Do not prime specific surfaces to be welded or which will be in direct contact with concrete or other cementitious materials.

2.6 WELDED STUDS

A. All welded studs shall be Nelson shear connector studs (ICC ESR-2856) or equal.

B. See Drawings for welded stud locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Surface Conditions: Prior to commencing work of this section, inspect the work of others and verify that such work has been properly completed and installed to allow for proper installation of materials and methods required of this section.

3.2 FABRICATION AND ERECTION

A. Fabricate and assemble work by skilled workers using sizes and weights shown. Connections are to develop at least strengths shown, unless approved otherwise beforehand. Allow no splices except where shown.

B. Drilling, Punching and Reaming: Hole burning to make or enlarge previous holes is not allowed. Prepare required holes in structural steel members for attachment or passage of work of other trades. Where allowed, steel may be punched 1/16-inch larger than the nominal diameter of the bolt when thickness of the steel is equal to or less than the diameter of the bolt plus 1/8-inch. Where the steel is thicker than the diameter of the bolt plus 1/8-inch, the holes must be drilled or sub-punched and reamed. Diameter of the sub-punched holes, and the drill for sub-drilled holes, is to be 1/16-inch smaller than the nominal diameter of bolt to be installed. Precisely locate finished holes to ensure passage of bolts through steel assemblies without drifting. Enlarge holes only by reaming. Poor matching of holes is cause for rejection of work.

C. Welding: Comply with the requirements of Title 24, Part 2, Sections 1705A.2 and 2204A.1. Perform welding by the electric shielded arc process. Cut out defective welds with a chisel. Clamp or hold materials securely in position for welding. Upon completion, remove slag and clean welds for inspections and painting. Groove and multi-pass welds are required to be continuously inspected.

1. Storage and Care of Electrodes: Ensure that coatings of low hydrogen type electrodes are thoroughly dry when used. Use electrodes taken from hermetically sealed packages within four hours of the time the package is opened. Electrodes not used within this time period, and electrodes which have been exposed more than one hour to air having a relative humidity of 75 percent or greater, are to be dried for at least two (2) hours at 200 to 250 degrees F. before used, or are to be

reconditioned according to manufacturer's printed recommendations. Electrodes dried or reconditioned, which are not used within four hours after drying is completed, are to be re-dried before use. Electrodes of any classifications that have been wet are not to be used under any conditions.

2. Preparation: Clean surfaces to be welded of paint, grease, scale, and foreign matter. Clean welds each time electrode is changed. Chip entire area of hand guided and controlled flame cut edges before welds are deposited. In general, surfaces made by automatic or mechanically guided and controlled equipment need not be ground or chipped before welded.

3. Procedures: During assembling and welding, hold components of a built-up member with sufficient clamps or other adequate means to keep parts straight and in close contact. Do no welding in wind until adequate protective screening has been set up.

4. Characteristics of Welds: After being deposited, brush welds and ensure they exhibit uniform section, smoothness of weld metal, feather edges without undercuts or overlays, and freedom from porosity and clinkers. Ensure through visual inspection at edges and ends of fillet welds there is good fusion and penetration into base metal.

D. Bolting:

1. Common Bolts: Make connections with common bolts only where indicated.

~~2. High Strength Steel Bolting: Where structural joints are made using high strength bolts, load indicator washers, and nuts tightened to a high tension, the materials, method of installation and tension control, types of wrenches to be used, and inspection methods are to conform to specifications for structural jointing using ASTM A325 or A490 bolts established by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation and the following requirements:~~

~~a. Provide high strength bolts with a suitable identifying mark placed on top of the head before leaving factory.~~

~~b. Do tightening of nuts with properly calibrated wrenches, load indicator washers, or turn of nut method; the minimum bolt tension for the size of bolt used is to be in accordance with tables listed in the above standards.~~

~~c. Check calibrated wrenches individually for accuracy at least twice daily for actual conditions of application.~~

~~d. Mark bolts that have been completely tightened with identifying symbol.~~

~~e. Install load indicator washers in accordance with AISC specifications and Contract Drawings.~~

f. ~~Ensure that contact bearing surfaces and threads of bolted parts are free of scale, slag, and burrs which could prevent solid seating of parts.~~

g. ~~Bolt lengths are to be grip plus 1-1/4 inch.~~

h. ~~At moment connections perform welding prior to high-strength bolt tightening~~.

E. Erection:

1. Erect structural steel by professional riggers, using proper hoists and equipment, carefully planned and laid out so that cutting shall not be necessary. Erect the work plumb, square and true to line. Provide temporary bracing and guys where necessary to provide for loads and stresses to which the structure may be subjected, including those due to erection equipment and its operation, and leave in place as long as necessary to safeguard parts of the work.

2. Temporary Connections: Securely bolt work to maintain the steel in proper position while bolting and welding is being performed. Align, plumb and level work prior to welding and final bolting.

3. Set column base plates in exact position as to alignment, level and elevation and support on steel wedges or equivalent until grout has properly set. Center of each base is to be true to the column center within 1/16-inch and adjusted to its elevation to 1/32-inch. Exactly level plates on both axes.

4. Sequence: Carry out the erection of steel in the proper sequence with the work of others. Frame, bed and anchor to concrete and related work in accordance with detailed drawings and setting diagrams.

5. Erection Tolerance: Follow AISC except as follows:

a. Vertical dimensions measured from top of beams at their connections at any one column, not varying more than 1/4-inch plus or minus per story or, when accumulative from floor to floor, not exceeding 3/8-inch per story exclusive of column shortening due to dead load.

b. Floor level is considered level if floor framing members on any one floor measured from top of column connections do not vary by more than 1-1/2 inch plus or minus.

c. Plumb displacement center line of columns from established column line, no more than 1 inch toward or away from established center line.

d. Horizontal dimension variances governed by column displacement.

6. Perform erection with suitable equipment, of adequate capacity and design with due regard for personnel and public safety and as not to deflect or stress members beyond reasonable limits. Maintain erection and temporary bracing plan at project site in accordance with Title 8, California Code of Regulations.

7. Damaged members during erection: Straighten or replace members which are bent, twisted or damaged as directed. If heating is required in straightening, perform heating by methods which ensure uniform temperatures throughout entire member. When directed, remove members which are damaged to an extent impairing their appearance, strength or serviceability and replace with new members at no additional cost to Owner.

8. Anchor Bolts: Provide with setting drawings and instructions. Verify position of bolts prior to delivery of steel; report errors or deviations for adjustment.

F. Erection Bracing: Provide erection bracing immediately upon erection of members and leave in place until members are braced by balance of building.

3.3 PROTECTION

A. Protection of Floors and Temporary Flooring:

1. Exercise caution to protect floor surfaces and adjacent work from damages. Do not overload floors. Provide only pneumatic mobile equipment with tires, for moving steel. Do not place steel members directly on concrete floors. Pads, timbers, or other materials for cushioning shall be used.

2. Provide necessary planking, scaffolding and temporary flooring in connection with erection of steel or support of erection machinery as part of the work. Conform use of temporary floors or steel deck to governing codes and regulations.

3. Temporarily tack weld steel deck to supports where used as a working platform. Distribute concentrated loads from welding machines or other heavy machinery by planking or other equivalent means. Replace steel deck damaged in using as working platform at no additional cost to Owner.

3.4 CLEANING

A. Shop Priming:

1. Clean surfaces according to SSPC and AISC recommendations, and apply specified primer to minimum 1.0 dry mil thickness. Ensure that primer is worked into joints.

2. Steel to be embedded into cementitious materials, permanently concealed steel surfaces, contact surfaces of high-strength bolted connections, and surfaces to receive fireproofing are not to be primed.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Miscellaneous framing supports.
   3. Miscellaneous steel trim.
   4. Trash enclosure gates.

B. Related Sections include the following:
   1. Division 9 Section “Painting” for field painting.

1.2 DEFINITIONS

A. Exterior: Defined as the following:
   1. Areas, locations, and surfaces that are unprotected, or exposed to environmental elements.
   2. Areas, locations and surfaces within uncontrolled environments.
   3. Areas, locations and surfaces of unconditioned spaces, including belowgrade/underground, partially-exposed, or “covered” parking areas.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For items specified.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal fabrications that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Corrugated Metal Panels for Trash Enclosure Gates:
   1. Tomen Building Components, Inc. (TBC), Ontario, CA. (Basis of Design)
   2. BHP Steel Building Products USA, Inc., West Sacramento, CA.
   3. Smith Steelite, Moon Township, PA.
   4. Verco Manufacturing Co., Phoenix, AZ.
   5. VicWest Steel, Oregon, Salem, OR.
   6. Or equal.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: 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.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
   1. Size of Channels: 1-5/8 by 1-5/8 inches or as indicated.
   2. Material: Galvanized steel complying with ASTM A 653, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
   1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Surface Preparation: SSPC-SP2 Hand Tool Clean and /or SSPC-SP3 Power Tool Clean.

D. Organic Zinc-Rich Primer: Complying with SSPC-Paint 20 and compatible with topcoat, and meets AISC slip coefficient as a Class B Coating.
   1. Surface Preparation: SSPC-SP6 Commercial Blast Clean.
   2. Products:
      a. Tnemec Company, Inc.; Tneme-Zinc 90-97, 2.5 to 3.5 mils DFT (Basis of Design)
      b. Other manufacturers listed in Division 9 Section “High Performance Coatings”.

c. Or equal.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Field painted exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.10 TRASH ENCLOSURE GATES

A. Gate Configuration, Frame Height, and Opening Width: As indicated on Drawings.

B. Framing: Fabricated steel tubes, angles, and plates as detailed on Drawings, hot-dipped galvanized finish after fabrication, with galvanized corrugated steel panel infill.

C. Corrugated Metal Panels: TBC-7.2 Industrial Panels, 18 gage, 1-1/2 inch deep, 36-inch wide coverage, corrugations spaced 7.2 inches on center, ASTM A526 with factory coating designation G90 complying with ASTM A525.

D. Gate Hardware:

1. As indicated on Drawings, welded-on heavy weight butt hinges, minimum 3-hinges per gate leaf, hot-dipped galvanized finish.
2. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

E. Finish: Field finish per Division 9 Section “Painting”.
1. Color: As indicated on Drawings.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

D. Field Finish: Comply with Division 9 Section “Painting” for field painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for sectional doors securely to and rigidly brace from building structure.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055134 - ALUMINUM LADDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Vertical ladders.

B. Related Sections include the following:
   1. Division 7 Section “Roof Accessories” for roof hatch and ladder safety post.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product.

B. Qualification Data: Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

B. Record of successful in-service performance.

C. Sufficient production capacity to produce required units.

D. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum ladders that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Ladders: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. O’Keeffe’s Inc. (Basis of Design)
   2. Royalite.
   3. Alaco.
   4. Cotterman.
   5. ACL.
   6. Or equal.

2.2 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

C. Fasteners: As recommended by ladder manufacturer.

2.3 VERTICAL LADDERS

A. Product: Model 501 Heavy Duty Tubular Rails Fixed Access Aluminum Ladder by O'Keeffe's Inc. or equal.
   1. Rungs: Not less than 1-1/4 inches in section and 18-3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
   2. Rungs shall withstand a 1,500 pound load without deformation or failure.
   3. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch wall thickness by 3 inches wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces. Channel side rails are not acceptable.

2.4 ALUMINUM FINISHES

A. Mill finish. As extruded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor securely using fasteners specified by manufacturer or others of equivalent or greater strength and corrosion resistance.

END OF SECTION 055134

SECTION 061000-ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Wood framing, miscellaneous furring for wall finishes, miscellaneous blocking and rough hardware.

B. Related Sections:

1. Finish Hardware, see Section 087100 – Door Hardware.
2. Millwork and other finish carpentry.

1.2 REFERENCE STANDARDS

A. Softwood Lumber: PS 20 - American Softwood Lumber Standard.

B. AWC – American Wood Council, National Design Specifications for Stress Grade Lumber and its Fastening.

C. West Coast Lumber Inspection Bureau (WCLIB), Standard No. 17 Grading Rules for West Coast Lumber.

D. Chapter 23, Part 2, Section 2303, Title 24, California Building Code, 2022.

E. Chapters 7, 23 and 35, California Building Code, 2022.

F. Plywood: U.S. Product Standard PS 1-19.

G. Lumber: U.S. Product Standard, PS 20-20.

1.3 QUALITY ASSURANCE

A. Provide lumber with visible grade stamp of an approved agency certified by NFPA.

1.4 DELIVERY, STORING AND HANDLING

A. Deliver and store materials at job site in a safe area, out of traffic and shored up, off ground surface.

B. Identify framing lumber by grades and store grades separately from each other.

C. Protect products with adequate waterproofing.

D. Exercise care in off-loading lumber to prevent damages, splitting and breaking.

E. Seasoning:

F. Deliver materials at earliest date possible to allow maximum; drying time on site.

G. Pile and strip lumber at site to allow free circulation of air with pile protected from sun and moisture.
H. Air-season lumber for at least 60 days before covering with finish materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber: PS 20 and WCLIB Standard Number 17; Douglas Fir/Larch; graded in accordance with NFPA Grading Rules; maximum moisture content of 19 percent, grades as scheduled on drawings.

1. Douglas fir shall be #1 Grade, except blocking may be #2 Grade and shall bear WCLIB grade stamp.

2. Pressure treated Douglas fir shall be No. 2 minimum and bear the AWPA quality mark. Cuts and holes shall be treated per AWPA Standard U1 (statements such as "or to refusal" are not permitted).

3. Comply with provisions of Title 24, CBC, 2022, Part 2, Section 2303.

B. Plywood:

1. Plywood for Roofs, Walls, and Floor Sheathing: PS 1-19 Structural I grade, APA C-D, exterior glue, except B-D for electrical and telephone panels.

2. Comply with CBC, 2022, Section 2303.

3. Roof and shearwall plywood shall be nominally 4 ft. x 8ft. in size. Do not use sheets less than 8 square feet, nor less than dimensions noted in paragraph 3.08 Plywood Placement.

2.2 ACCESSORY MATERIALS

A. Nails, Spikes, and Staples: Common (with standard lengths), except as otherwise indicated, galvanized for exterior locations, high humidity within conditioned spaces, and treated wood; plain finish for other interior locations; size and type to suit application.

B. Steel Hardware and Stock Framing Products by Connectors: ASTM A36 steel, galvanized for exterior applications, Simpson Strong-Tie Company. Products by KC Metal Products, or other approved manufacturer, may be substituted if equal. Comply with CBC, 2022, Title 24, Part 2, Chapter 23.

C. Lag Bolts: ANSI/ASME B18.2.1 and ASME B18.18.1.

D. Wood Preservative: Wolmanizing treatment at least two weeks prior to delivery to site. Treatment shall meet or exceed AWPA U1 and M4.

E. Machine Bolts: ASTM A307.

F. Pressure Treatment: Sills and plates in contact with concrete or masonry within 48 inches of the ground, and wood posts and columns bearing directly on concrete shall be water-borne preservative pressure treated in accordance with paragraph, CBC 2022, Title 24, Part 2, Chapter 23.

1. At cuts, holes, notches and other field operations which expose a surface not factory treated with preservative, field apply preservative material compatible with original material shall bear mark AWPA Standard U1 and M4.

2. Meet local Air Quality Control Board Standards for field applied preservative treatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Selection of Lumber: Carefully select members. Ensure that exposed members are free of heart center. Select members so that knots and obvious defects will not interfere with placement of bolts, proper nailing or making proper connections, and not impair achievement of proper finished appearances where to be exposed.

B. Cut out and discard defects which will render a piece unable to serve its intended function. Lumber may be rejected by Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

3.2 GENERAL FRAMING

A. In addition to framing operations normal to fabrication and erection indicated on drawings, install wood backing required for work of other trades, and for casework, chalkboards, toilet partitions and etc. as required. Wood backing to be installed in high traffic and high impact areas.

B. Set horizontal and sloped members with crown up.

C. Non-bearing stud walls, sills, and trimmers may be anchored to concrete per Structural Drawings.

D. Wall and partition studs and mullions shall be continuous from sill to plates. Run at least two studs on each side of openings in stud walls for openings in exterior walls and in partition openings larger than 5 feet, and partitions from sill to plate. In addition, place one stud trimmer to support each end of lintels over openings, unless shown otherwise.

E. Provide double plates with joints staggered and lapping at least four feet, and splice. Nail as required on Drawings.

F. Install nailing blocks and backing necessary for attachment of grounds, finishes, trim, fixtures, and do required cutting, furring, and backing for plumbing and heating pipes, fixtures, etc., as detailed in the Drawings or approved by the Structural Engineer and approved by the Division of the State Architect, Office of Regulations Services.

G. Frame stud partitions, furring and walls containing fire extinguisher cabinets, electric panels, plumbing, heating, or other pipes to give proper clearance. Cutting of studs in bearing partitions and shear walls is prohibited unless specifically detailed.

H. Do not place pipes exceeding 1/3 of plate width in partitions used as bearing or plywood-sheathed walls, but place them in furring completely clear of studs, unless detailed otherwise. Place approved piping in center of plates using neat hole. No notching is allowed. In no case allow pipes to pass through plates less than 5-1/2 inches wide.

I. Unless otherwise indicated provide 2 inch by 6 inch studs at 16-inches on centers. Refer to Structural Drawings for Simpson Metal Strap Ties, strap length, nail size and nail spacing where plates are broken.

J. Provide cross-bridging at 10 feet on centers maximum for all joists and rafters more than 10-inches deep. Use wood 2 inch by full depth of joist or rafter or approved metal type bridging. Nail metal bridging.

K. Provide isolated posts with connections at top and bottom; Simpson CC caps or CB base unless specifically detailed otherwise.

L. Double joists under parallel partitions with solid blocking between joists over points of support.

M. Provide a Simpson "CB" Steel Base Plate for untreated wood posts where they are or will be in contact with concrete.

N. Framing for horizontal plaster assemblies shall comply with the requirements of CBC 2022, Title 24, Part 2, Section 2507.

3.3 FIRE BLOCKING

A. Fire blocking shall conform with the requirements of CBC 2022, Title 24, Part 2, Chapter 7, Section 713.

B. Ensure that no fire stop is less than nominal 2 inches thick and no less in width than enclosed space within partition.

C. Provide stud wall and partitions with continuous rows of bridging or fire stops which will form a complete and effective separation in entire width of partitions, placed in such a manner that there will be no concealed air spaces greater than 8 feet in vertical dimension. Intermediate stops may be in line with opening headers. Provide furred space between stud walls and partitions with continuous fire stops at same elevation as those in the enclosing walls which must be installed horizontally, thus forming a solid stop from outside to outside of studs. At concealed draft passages or shafts including furring spaces, ensure that maximum dimension is no more than 8 feet. Provide fire stop partitions at suspended ceilings.

3.4 BEARINGS

A. Make bearings full unless shown otherwise.

B. Finish bearing surfaces on which structural members are to rest so as to give sure and even support. Where framing members slope, cut or notch ends as required to give uniform bearing surface.

3.5 SHIMMING

A. Do not shim framing member except where specifically shown or required by drawings.

3.6 BLOCKING

A. Install blocking required to support items of finish and to cut off concealed draft openings, both vertical and horizontal, between ceiling and floor.

3.7 ALIGNMENT

A. On framing members to receive a finished surface, align finish sub-surface to vary not more than 1/8-inch from plane of surface of adjacent framing and furring members.

3.8 PLYWOOD PLACEMENT

A. All installed plywood shall be in 4' x 8' sheets except where restricted by boundaries or changes.

B. Minimum Plywood Panel Sizes shall be as follows:

1. In horizontal plywood diaphragms, no panel less than 24 inches wide or 48 inches long shall be used.

2. In vertical plywood diaphragms, no panel less than 24 inches wide shall be used.

C. Center joints accurately over support unless otherwise shown on Drawings. Provide gapping of plywood substrate of 1/8-inch at abutting joints at all wall.

D. Protect plywood from moisture until succeeding component or materials are installed to cover plywood. Delaminating plywood shall be removed and replaced.

3.9 FASTENING

A. Use only common wire nails or spikes of standard lengths and gages as specified Table 2304.10.1, of the California Building Code, 2022, unless otherwise noted on drawing.

B. For conditions not covered on drawings, Contractor to request clarification or provide penetration into piece receiving point not less than 1/2 length of the nail or spike, provided that 16d nails may be used to connect two pieces of nominal 2 inch thickness as specified by the Architect, and/or Structural Engineer and approved by the Division of the State Architect.

C. For bolts, drill holes 1/32-inch to 1/16-inch larger in diameter than bolts being used. Drill straight and true from one side only.

D. Bolt threads shall not bear on wood. Use washers under head and nut where both bear on wood. Use washers under nuts.

E. For lag-screws, and wood screws, pre-bore holes in accordance with CBC 2022, Title 24, Part 2, Chapter 23.

F. Screw, do not drive, lag screws and wood screws.

G. Nailing schedule shall be per CBC 2022, Title 24, Part 2, Chapter 23.

3.10 HOLLOW METAL FRAME GROUTING

A. At all exterior hollow metal jambs, drypack/grout the bottom 6-inch space between the hollow metal and 6-inch concrete curb at the wall. The intent is to fill solid the void between the frame and concrete curb. Install drypack/grout before any finishes are applied to the studs.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Plywood sheathing.
   2. Air Barriers.
   3. Sheathing joint-and-penetration treatment.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

B. Installer Qualifications:
   1. Installer must provide documentation of having completed at least 5 fluid applied air barrier systems projects in the last 5 years.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheathing that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
   2. Warranty Period: 5 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fluid-Applied Air Barrier Membrane:
1. GCP Applied Technologies. (Basis of Design)
2. W.R. Meadows, Inc.
3. Omega.
4. DuPont.
5. Sto.
6. Prosoco.
7. Or equal.

2.2 WALL SHEATHING

A. Plywood sheathing: Comply with structural Drawings.

2.3 FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR PERMEABLE

A. Product: Perm-A-Barrier VPL 50RS UV Stable (20 mils) as by GCP or equal.
1. Description: Fluid-applied, vapor permeable, silyl terminated polyether (STPE) membrane that cures to form a resilient, monolithic, fully bonded elastomeric membrane when applied to construction surfaces.
2. Membrane Air Permeance: ASTM E2178: Not to exceed 0.004 cfm/ft.2 under a pressure differential of 0.3 in. water (1.57 psf).
3. Assembly Air Permeance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.04 cfm/ft.2 of surface area under a pressure differential of 0.3 in. water (1.57 psf) when tested in accordance with ASTM E2357.
4. Water Vapor Permeance: ASTM E96, Method B: Greater than 10 perms @ 20mil.
5. Pull Adhesion: ASTM D4541: minimum 30 psi or substrate failure to glass faced wall board, minimum 50 psi to concrete/CMU.
6. Low temperature flexibility: ASTM D1970: Pass at minus 20 degrees F.
7. Water resistance of in-place membrane: ASTM E331: Pass. No water penetration tested at 15 psf.
8. Nail sealability per ASTM D1970: Pass.
9. UV Exposure Limit: Minimum 365 calendar days.
10. Inservice temperature capability of 200ºF.
11. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
12. Membrane shall be Black in color.
13. Transition Membrane Accessories:
    a. Perm-A-Barrier Detail Membrane.
    b. Perm-A-Barrier NPS Detail Membrane.
    c. Perm-A-Barrier Aluminum Flashing.
    d. Perm-A-Barrier Wall Flashing.

e. Perm-A-Barrier Liquid Flashing.
f. Perm-A-Barrier S100 Sealant & PAB Liquid Flashings.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Power-Driven Fasteners: NES NER-272.

2.5 MISCELLANEOUS MATERIALS

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
1. Vapor-Permeable Membrane Air Barrier: 20-mil thickness

D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove air barrier that do not comply with requirements; repair substrates and reapply air barrier components.

3.3 TRANSITION MEMBRANE INSTALLATION

A. All transition membranes must be placed prior to application of air barrier.

B. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition membrane to substrate with termination of sealant and liquid flashing.

E. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when seal-ant cannot be applied within these temperature ranges.

F. Wall Openings: Apply transition membrane so that a minimum of 3 inches of coverage is achieved over both substrates.
   1. Transition Membrane: Roll firmly to enhance adhesion.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with sealant.

H. Repair punctures, voids, and deficient lapped seams in strips and transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches beyond repaired areas in strip direction.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage and pay for a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air-barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   4. Site conditions for application temperature and dryness of substrates have been maintained.
   5. Maximum exposure time of materials to UV deterioration has not been exceeded.
   6. Surfaces have been primed, if applicable.
   7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   8. Termination mastic has been applied on cut edges.
   9. Strips and transition strips have been firmly adhered to substrate.
   10. Compatible materials have been used.
   11. Transitions at changes in direction and structural support at gaps have been provided.
   12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   13. All penetrations have been sealed.

C. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 061600

SECTION 062000-FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Handrails, chair-rails, trim, and soffits.

B. Related Sections:

1. Rough Carpentry; refer to Section 06 10 00.
2. Specialties; refer to Division 10.

1.2 REFERENCE STANDARDS

A. Woodwork Institute, 2nd Edition, 2014 Architectural Woodwork Standards, has recommendations for materials, construction, and installation procedures.

B. West Coast Lumber Inspection Bureau (WCLIB), Standard No. 17 Grading Rules for West Coast Lumber.

1.3 QUALITY ASSURANCE

A. Provide millwork fabricated in accordance with recommendations of Woodwork Institute. Fabricated millwork shall be certified and grades stamped with Woodwork Institute certification.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver and store materials at job site in a safe area, out of traffic and shored up off ground surface.

B. Do not store millwork outside. Do not deliver millwork to project until spaces or other surfaces to receive it are prepared.

C. Protect products with adequate waterproofing.

D. Exercise care in off-loading items to prevent damages, chips, splitting and breaking.

1.5 PROJECT CONDITIONS

A. Seasoning:

1. Deliver materials at earliest date possible to allow maximum drying time on site.

2. Air-season lumber for at least 60 days near job site before covering with finish materials.

1.6 SUBMITTALS

A. Provide manufacturer's standard color samples of plastic laminate (where applicable) and

hardwood veneers for color and grain selection.

B. Provide Woodwork Institute Certified Compliance Certificates for millwork items, certifying that products fully comply with requirements of the grades specified.

C. Prepare Shop Drawings in accordance with Section 1 of the WI Standards referenced. Include the Woodwork Institute Certified Compliance label on the first page of each set of Shop Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Finish Lumber: Graded in accordance with Western Wood Products Association Grading Rules; maximum moisture content of 15 percent.

ITEM	SPECIES	GRADE
Misc. Trim	Red Oak, rift cut	Custom
1 x 4 tongue and groove siding	Redwood	Grade A, square edge, random length.

2.2 ACCESSORIES

A. Nails, Spikes, and Staples: Common, except as otherwise indicated, galvanized for exterior locations, high humidity within conditioned spaces, and treated wood; plain finish for other interior locations; size and type to suit application.

B. Lag Bolts: ANSI/ASME B18.2.1 and ASME B18.18.1.

C. Machine Bolts: ASTM A307

D. Wood Preservative: Wolmanizing treatment at least two-weeks prior to delivery to site.

2.3 FABRICATION

A. Manufacture, mill, fabricate, assemble and finish millwork by skilled mechanics, using approved standard methods of manufacture and workmanship. Workmanship shall conform to the Custom Grade requirements of Woodwork Institute Manual referenced.

B. Conceal means of fastening where other than glue joinery is employed. Use fine casing nails, carefully set without hammer marks.

C. Level tops of counters and cabinetry to a tolerance of 1/32-inch in 4 feet in direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Selection of Lumber: Carefully select members so that defects will not interfere with proper nailing or making proper connections, and not impair achievement of proper finished appearances where to be exposed.

3.2 INSTALLATION

A. Installation of finish carpentry and millwork shall be in accordance with the applicable recommendations of the Woodwork Institute Manual, current edition, Architectural Woodwork Standards.

B. Install building specialty items specified under other sections which are not specified to be installed by specialty product manufacturer or supplier.

END OF SECTION

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate cabinets.
   2. Solid-surfacing-material countertops.

1.2 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

B. NAAWS: Formally Woodwork Institute.

1.3 SUBMITTALS

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

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
   3. Apply NAAWS-certified compliance label to first page of Shop Drawings and follow Section 1, “Guidelines for Architectural Millwork Shop Drawing”.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
   2. Solid-surfacing materials, 6 inches square.
   3. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
      b. Miter joints for standing trim.
   4. Exposed cabinet hardware and accessories, one unit for each type and finish.
      a. Hardware samples will be returned up on approval.

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Compliance Certificate: At completion of installation the woodwork installer shall provide a NAAWS Certificate (formally Woodwork Institute Certified Compliance Certificate) indicating

the products installed, and Certifying that the installation of these products fully meets the requirements of the Grade or Grades specified.

F. Qualification Data: For Installer and fabricator.

1.4 QUALITY ASSURANCE

A. Cabinet and Drawer Hardware:
   1. Operable parts for all accessible casework shall comply with CBC Section 11B-309.
   2. Provide U-pulls at cabinets/casework for accessible storage.

B. Minimum standards for work in this Section shall be in conformity with North American Architectural Woodwork Standards, latest edition (NAAWS).
   1. Work shall be in accordance with the Grade or Grades specified of the North American Architectural Woodwork Standards.

C. Certified Compliance
   1. Before delivery to the jobsite the woodwork supplier shall provide a Woodwork Institute Certified Compliance Certificate indicating the millwork products being supplied and Certifying that these products fully meet the requirements of the Grade or Grades specified.
   2. Each elevation of casework, each laminated plastic top, and each solid surface top shall bear a Woodwork Institute Certified Compliance Label.
   3. At completion of installation the woodwork installer shall provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and Certifying that the installation of these products fully meets the requirements of the Grade or Grades specified.
   4. All fees charged by the Woodwork Institute for their Certified Compliance Program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of interior architectural woodwork that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. High-Pressure Decorative Laminate:
   1. Wilsonart International; Div. of Premark International, Inc. (Basis of Design)
   2. Formica Corporation.
   3. Nevamar Company, LLC; Decorative Products Div.
   4. REHAU.
   5. Or equal.

B. Solid Surfacing Materials:
   1. Wilsonart International; Div. of Premark International, Inc. (Basis of Design)
   2. Corian by E. I. du Pont de Nemours and Company.
   3. Formica Corporation.
   4. LG Hausys.
   5. Nevamar Company, LLC; Decorative Products Div.
   6.
   7. Or equal.

C. Medium-Density Fiberboard:
   1. Medex, Medex NC, Medite II, or Arreis SDF by SierraPine Ltd.
   2. Weyerhaeuser Company; Premier Plus by Weyerhaeuser.
   3. Or equal.

D. Particleboard:
   1. Rodman Industries, Inc.
   2. Acadia Board Company.
   3. PrimeBoard, Inc.
   4. Or equal.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Core and Substrates: Comply with the following:
   1. Backs of cabinets, book cases, etc.
      a. Hardboard: AHA A135.4.
   2. Plastic-laminates:
      a. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
   3. Wood Veneer-Faced Panel Products, melamine, and shelving:
      a. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
   1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

D. High-Pressure Decorative Laminate (HPDL): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
   1. Colors: As indicated on Drawings.

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Type: Standard type, unless Special Purpose type is indicated.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Adjustable Shelf Pilaster Standards: Side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
   1. 23 gauge high strength steel.
   2. 39/64" wide x 11/64" deep.
   3. BHMA Grade 1 approved.

B. Shelf Support Pins:
   1. Stainless steel.
   2. Pin diameter for 5 mm hole (approx 13/64 inch).

C. Grommets: Plastic, 2 inch diameter, locations as indicated. If locations are not indicated, as selected by Architect during shop drawing review or a minimum of 1 Grommet per 3 linear feet of countertop.
   1. Doug Mockett or equal.

D. Drawer and Door Pulls: For all, including accessible casework.
   1. "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish to key with door hardware. All doors and drawers to be lockable.

F. Hinges: European fully concealed hinges, ANSI-BHMA Grade 2, “self-closing”. Blum Clip Top, Grass Nexus or equal.
   1. Opening angle: 120 degrees per the NAAWS.

G. Drawer Slides: BHMA A156.9, B05091.
   1. Heavy Duty (Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect 7 days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of openings in countertops with a coat of varnish.

E. Drawer bottoms to be fully let-in, glued and blocked. Joinery must be lapped and mitered, no butt joints.

2.6 PLASTIC-LAMINATE CABINETS

A. NAAWS Construction Style: Style A, Frameless.

B. NAAWS Construction Type: Type I, multiple self-supporting units rigidly joined together.

C. NAAWS Door and Drawer Front Style: Flush overlay.

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS, 0.048 inches (1.2 mm) thick.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS, 0.048 inches (1.2 mm) thick.
   4. Edges: Self-edge banded.

E. Semi-Exposed Surfaces: Any of one of following.
   1. Low pressure decorative polyester overlay.

2. Low pressure decorative melamine overlay.
3. HPL cabinet liner.
4. Solid Phenolic core (SPC).
5. Vinyl at cabinet backs and drawer bottoms only.

F. Concealed Surfaces: Any of one of following.
1. Solid Wood or Plywood: Any hardwood or softwood species, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Medium-Density Fiberboard: ANSI A208.2.
4. Solid Phenolic core (SPC).

2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Solid-Surfacing-Material Thickness: 3/4 inch.

B. Edge: 1-1/2 inch thick eased edge.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

D. Integral Cove: Provide shop fabricated integrally molded coves at back and ends where against walls or other vertical surfaces, with 3/8” radius between top and splash.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
   4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 071909 - CONCRETE MOISTURE AND ALKALINITY TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for independent testing and inspection requirements for concrete moisture and alkalinity.

B. Related Sections include the following:
   1. Division 7 Section “Concrete Moisture and Alkalinity Barrier” for concrete sealers to reduce moisture and alkalinity level when testing fails.

1.2 SUBMITTALS

A. Independent testing agency qualifications: Past 4 year history of testing of comparable project size and scope.

B. Product data: Moisture test kit.

C. Testing Results: Provide interior temperature, humidity, moisture vapor and alkalinity results for testing period.
   1. Alkalinity and Adhesion Test Report.
   2. Moisture Test Report.

D. Locations Map: Provide each testing result documented on a locations map. Map may be finish floor plan by Architect or similar representation.

E. Record Submittals: Testing reports and locations map.

1.3 SCHEDULING

A. Site Meeting: Testing Agency, Owner, Architect and Contractor shall meet 30 days prior to flooring installation to discuss testing requirements, specifications and locations prior to testing.

PART 2 - PRODUCTS

2.1 MOISTURE TESTING

A. Test Method: ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
   1. ASTM F 1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride is NOT acceptable method.

B. The In-Situ Method:

1. In-situ probes deepen concrete moisture measurement. For decades, builders used (and some still do) the anhydrous calcium chloride test for concrete moisture vapor emissions rate (MVER). The MVER is defined as the rate of water vapor emissions from the surface of concrete and is determined with the use of a desiccant material sealed to the slab surface for a specified time period, then measured. It has been believed that the change in the desiccant weight could be translated into a moisture ratio for the concrete beneath.
2. In-situ concrete moisture testing places sensors, or probes, inside the slab itself. As concrete dries, moisture migrates from the bottom of the slab to the surface where it can evaporate away. Logically then, moisture levels at the bottom of a slab will read higher from those at the surface. In-situ probes provide relative humidity (RH) measurements at 40% of the slab's depth*, a position proven to more accurately portray the final RH levels of the slab if it were to be sealed at that point in time and the slab moisture allowed to fully equilibrate.

C. Acceptable Testing Devices for ASTM F2170 Test:
1. Wagner Meters Rapid RH® system by Wagner.
2. Protimeter by T Equipment.
3. Relative Humidity Meter system by American Moisture Test.
4. Or equal.

2.2 ALKALINITY TESTING

A. Alkalinity Test, ASTM F 710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
1. Digital wide range 1–14 pH meter.
2. Waterproof flat tip.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site: Weatherproofed, doors installed and windows secured. Do not start testing process when site has standing water, surface contaminates, exposed to exterior conditions or concrete installation is less than 90 days of age.

3.2 PREPARATION

A. Clean concrete substrates of adhesives residue, paint, curing, sealing, floor coverings a minimum of 24 hours prior to installation of testing equipment.

B. Temperature & Humidity: Maintain site at the temperature and humidity conditions to those anticipated during normal occupancy and maintain these conditions minimum of 7 days (exceed ASTM F1869 requirements) prior and during testing period.

C. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with testing results.

3.3 MOISTURE TESTING

A. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F2170.

B. Floor shall have reading of 95% or less per ASTM F2170; unless finish flooring product require better value.

3.4 ALKALINITY TESTING

A. Test: Perform pH testing per ASTM F710.

B. pH range between 8 and 10; unless finish flooring product require better value.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage and pay for qualified independent testing agency specified to perform the following field tests and inspections and prepare test reports:
   1. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures.
   2. Testing agency shall verify thickness of coatings during traffic coating application.
   3. If test results show coating materials do not comply with requirements, remove noncomplying materials, prepare surfaces, and reapply coatings.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 071909

SECTION 071910 - CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes concrete stain and sealer.

1.2 SYSTEM DESCRIPTION

A. Ground and Floor Surfaces: Slip resistant per CBC 11B-302.1.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include manufacturer's printed statement of VOC content.

B. Samples for Initial Selection: For each type of stain finish indicated.

C. Samples for Verification: For each type of stain required, prepared on rigid backing and of same thickness and material indicated for the Work.

D. Samples: For each type of sealer and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

E. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Ambient temperature is above 40 deg F.
2. Concrete surfaces and mortar have cured for more than 28 days.
3. Concrete or brick masonry walls are not treated prior to 30 days after building close-in.
4. Rain or snow is not predicted within 24 hours.
5. Application proceeds more than 24 hours after surfaces have been wet.
6. Substrate is not frozen, or surface temperature is above 40 deg F.
7. Windy conditions do not exist that may cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Patching compound, cementitious, thin patching and skim-coating material, designed for reducing surface defects on interior floors. : Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Degussa.
   2. ChemMasters.
   3. Or equal.

B. Concrete Clear Sealer for protecting antiqued, imprinted, chemically stained, exposed-aggregate, and colored or uncolored concrete hardscapes and floors: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Glaze ‘N Seal. (District Standard)

2.2 PATCHING COMPOUND

A. Patching compound, cementitious, thin patching and skim-coating material, designed for reducing surface defects on interior floors.
   1. Composition and Materials:
      a. Complex, precisely engineered, polymer-modified, cementitious, thin patching material produced by a proprietary manufacturing and intergrinding process.
      b. Designed for ease of mixing and installation, superior adhesion without priming, and rapid strength gain, it is a single-component, non-gypsum-based, powdered material containing no sand or calcium chloride.

2.3 SEALER

A. Product: "Natural Look" Penetrating Sealer by Glaze 'N Seal or equal.
   1. Description: This sealer reacts with carbon dioxide and atmospheric moisture to form a penetrating water repellent barrier within 24 hours. The extreme low moisture absorption provided by this sealer shows little change for up to ten years.
   2. Non-Flammable.
   3. No odor – water based.
   4. Reduces Efflorescence Problems.
   5. Mildew Resistant.

PART 3 - EXECUTION

3.1 PREPARATION

A. New Concrete:
   1. Newly placed concrete shall be sufficiently cured to allow concrete to become reactive, minimum 28 days.
   2. Do not use liquid curing materials. Cure concrete flatwork with new, unwrinkled, non-staining, high quality curing paper. Do not overlap curing paper.
   3. Surfaces shall be cured using the same method and different sections (pours) chemically stained when the concrete is the same age.
   4. Immediately prior to chemically staining, thoroughly clean the concrete. Sweep surfaces, the pressure wash or scrub using a rotary floor machine. Use suitable, high-quality commercial detergents to facilitate cleaning. Rinse surfaces after cleaning until rinse water is completely clean. Allow floor to dry completely prior to application of floor stain.
   5. Concrete surfaces must be uniformly slip-resistant and profiled to meet a Concrete Surface Preparation (CSP) profile of 1-2 per ICRI guidelines.
   6. Some concrete may require abrading to open the surface and make it sufficiently penetrable. In these instances the concrete surface must be sanded using an 60-80 mesh-sanding screen or a grit brush. After sanding, all residue must be removed by power vacuuming. The surface should then be pressure washed or scrubbed using a rotary floor machine.
   7. For preparation, the sandblaster should be capable of producing a light, uniform sandblast and be equipped with a dust collector.
   8. For preparation, the pressure washer should be equipped with a fan tip and have a minimum pressure capability of 4000 psi. Hot water capability may facilitate cleaning of existing concrete.
   9. Acid washing may be required when the above surface preparation does not yield adequate penetration or if there are excessive alkali deposits or surface discoloration. The reacted residue must be abraded using a low-speed floor machine equipped with a 60 mesh screen or a grit brush and then thoroughly rinsed until the rinse water is clear and free of solids, a minimum of two times. After rinsing, neutralize any remaining acid residue by washing with a solution of baking soda (sodium bicarbonate) and water. (Test pH of floor should be 7 or higher.)

B. Existing Concrete:
   1. Clean concrete surfaces so that surfaces are completely penetrable before receiving the initial application of chemical stain. Test surfaces to receive stain by spotting with water. Water should immediately darken the substrate and be readily absorbed. If water beads

and does not penetrate or only penetrates in some areas, additional surface preparation and testing shall be performed.

2. Cleaning method used depends on the condition of the concrete surface. To remove dirt and other contaminates, detergents and other commercial grade cleaners should be considered and tested.
3. Rinse concrete substrates until rinse water is completely clean.
4. For preparation of interior floors, the rotary floor machine should be heavy duty and operate at approximately 175 rpm. With a 60-80 mesh-sanding screen or a grit brush, remove all contaminates and weak cement paste from the surface. This will also open the surface to allow the chemical stain to penetrate.
5. Acid washing may also be required. (Refer to New Concrete Preparation.)

C. Scoring: Score decorative jointing in concrete surfaces 1/8-inch (3.2 mm) deep with diamond blades. Rinse until water is completely clean.

3.2 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

C. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.3 APPLICATION OF SEALER

A. Concrete substrate shall be completely dry.

B. Sealer shall be produced by the water-based reactive stain manufacturer.

C. After the final stain application has dried sufficiently, normally 8-24 hours at 75 F and 50 percent relative humidity, remove all contaminates from the surface by dry mopping if required.

D. Apply sealer according to manufacturer’s written instructions at a rate of 300 to 500 square feet per gallon per coat. Two coats are required.

E. Maintain a wet edge at all times.

F. Allow sealer to completely dry before applying additional coats.

G. Apply second coat of sealer at 90 degrees to the direction of the first coat using the same application method and rates.

H. Seal horizontal joints in areas subject to pedestrian or vehicular traffic.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071910

SECTION 071920 - CONCRETE MOISTURE AND ALKALINITY BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Concrete moisture and alkalinity barrier when moisture or alkalinity test fails.

B. Related Sections include the following:
   1. Division 7 Section “Concrete Moisture and Alkalinity Testing” for independent moisture and alkalinity testing prior to installation of flooring materials.

1.2 PERFORMANCE REQUIREMENTS

A. Ground and Floor Surfaces: Slip resistant per CBC 11B-302.1.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include manufacturer's printed statement of VOC content.

B. Samples: For each type of barrier and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

C. Manufacturer Certificates: Signed by manufacturers certifying that barrier comply with requirements.

D. Qualification Data: For Installer.

E. Product Test Reports: Independent third party testing results:
   1. ASTM E 96 Water Vapor Transmission: up to 95% Vapor Reduction
   2. ASTM D 4541 Concrete Adhesion: 500psi or concrete cohesive failure
   3. ASTM D 1308 Chemical Resistance: 100% resistant to acid and alkali

F. Field Quality Control Documents: Post installation testing by independent testing agency per ASTM F1869, ASTM D 4541.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Extended Warranty Period: Barrier warranty for 15 years covering performance, concrete adhesion, moisture or alkalinity damage to barrier and installed floor coverings. In the event of barrier failure, manufacturer shall cover labor and material cost to replace moisture or alkalinity damaged flooring or coatings, reapply barrier, adhesives, patching compounds and installation accessories.

1. Moisture Vapor Reduction: No upper performance limitations.
2. Alkalinity Control: No upper performance limitations.
3. Manufacturing defects warranties are not acceptable.

B. Warranty shall not exclude ACI documents, dew point, concrete salts, admixtures, resin and silicate surfaces treatments. Installations on slab surfaces deems acceptance of on site conditions. Barrier manufacturer is responsible for complete review of concrete mix designs, admixtures, sub slab vapor barrier installed and curing methods for written acceptance prior to installations.

C. Installer: Submit 15 year warranty covering installation defects and improper installations on workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Concrete Moisture and Alkalinity Barrier: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. VAP-1 2000 FS by Koster. (Basis of Design)
2. Vapor-Guard DC by Advance Moisture Control.
3. MES 100 by Floor Seal Technology Inc.
4. Or equal.

2.2 CONCRETE MOISTURE AND ALKALINITY BARRIER

A. Product: VAP I 2000 FS by Koster or equal.
1. Fast-setting, one-coat, membrane-forming, moisture vapor control system consisting of a unique combination of epoxy resins and other compounds formulated to prevent floor covering failures on concrete slabs with elevated levels of moisture.
2. Meets or exceeds the performance requirements in ASTM F3010-13 Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
3. Has no upper limit for water vapor emission from concrete floor slabs. It can be applied to concrete slabs with relative humidity up to 100% RH and it provides protection from sustained exposure to pH 14.
4. Low permeance of 0.047 perms, moisture blocker for virtually all types of flooring, including low permeance flooring such as sheet goods and rubber tile.
5. Compliant with all state and federal VOC regulations, having VOC content of 0 g/L, which allows installation in sensitive areas such as hospitals, schools, and grocery stores.

B. Concrete Topcoat: Cement based self-leveling underlayment product acceptable to sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to barrier manufacturer's written instructions, to ensure that surface is dry enough.
   1. Shot blast surface to allow maximum penetration and adhesion. Grind near walls and edges.

B. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

C. Coordination with Sealants: Do not apply barrier until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Barrier work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Barrier: Apply by squeegee and roller application methods to saturate entire surface. Spread rates shall produce results of up to 95% moisture reduction per ASTM E 96 and post installation testing rate specified.

B. Roller and squeegee methods to saturate concrete porosity. Final surfaces shall be light reflective white.

C. Joint and Crack Treatment: Apply barrier directly over cracks, holes, and slab imperfections for maximum flexibility, moisture vapor and alkalinity control.

D. Cement Topcoat: As required for applications under resilient flooring for sealants installed after curing of concrete.

3.3 FIELD QUALITY CONTROL

A. Site Tests:
   1. Conduct moisture-alkalinity test by an independent testing company prior to resilient flooring and carpet installation.

3.4 CLEANING

A. Immediately clean barrier from adjoining surfaces and surfaces soiled or damaged by barrier application as work progresses. Repair damage caused by barrier application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071920

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Concealed thermal and sound insulation.

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.2 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 SUBMITTALS

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

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of building insulation that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass-Fiber Batt/Blanket Thermal and Sound Insulation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Johns Manville (JM). (Basis of Design)
   2. CertainTeed Corporation.
   3. Guardian Fiberglass, Inc.
   4. Knauf Fiber Glass.
   5. Owens Corning.
   6. Lamtec.
   7. Or equal.

2.2 GLASS-FIBER BATT/BLANKET INSULATION

A. Unfaced, Glass-Fiber Batt/Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Glass-fiber bonded with acrylic thermosetting binder.
   1. For walls and partitions: Unfaced Batts.
   2. Formaldehyde-free, Unfaced Batts by JM or equal.

B. Faced, Glass-Fiber Batt/Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft vapor-retarder membrane on 1 face.
   1. For ceilings under decks: FSK-25 Faced Batts with 2 inch tabs or Panel Deck FSK-25 Faced Batts with 5 inch tabs.
   2. Formaldehyde-free, FSK-25 Faced Batts by JM or equal.

C. Thermal Rating: R values as indicated on Drawings.

2.3 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.

B. Nails or Staples: Steel wire; electroplated, or galvanized; type and size to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install insulation in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
   4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
   6. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

D. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces for sound deadening, sound absorption, thermal protection, or air-infiltration reduction. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.5 INSTALLATION OF INSULATION IN CEILINGS

A. Install insulation to achieve thermal indicated attached to roof or floor deck from below.

B. Insulation to roof or floor deck: Install by one of following methods.
   1. Staple insulation to sides of joists or trusses at 4 inches o.c. through bent down flanges of vapor barrier in such manner that air leaks between insulation and joints are minimized.
   2. Fasten insulation anchors to deck substrates with insulation anchor according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 0741 00

METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Standing seam metal roofing system.

B. Standing seam metal roofing accessories.

C. Metal roofing accessories.

D. Required underlayment

1.2 RELATED DOCUMENTS

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

B. Provide all labor, equipment, and miscellaneous materials to install District furnished CMAS materials for indicated roofing sections/buildings over the properly prepared substrate.

C. responsible to provide all materials required to install the specified roofing system which are not provided by the school District. District provided materials are listed in the back of this specification. Contractor is responsible to install system as specified by manufacturer's installation requirements and details. Additionally, contractor shall purchase shop drawings from Garland as required by the manufacturer's warranty.

D. Contractor shall coordinate with Garland a cut list of specified roof panels and accessories necessary to complete the project base on site measurements in coordination with Garland's technical team.

E. Contractor is required to break District supplied flat stock as necessary for field or shop fabricated conditions.

F. Contractor responsible to unload all materials from delivery trucks as materials will be staged at the Site. Contractor is responsible to unload those materials at the site and load to roof. Materials accepted to site by contractor shall then be contractor's 100% responsibility.

1.3 REFERENCES

A. ASTM D 1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
B. ASTM D 3575 - Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.
C. ASTM E 283 - Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
D. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
E. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
F. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
G. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

H. ASTM E 2140 - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.
I. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
J. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
K. FM 4470 Approval Standard for Class 1 Panel Roofs.
L. FM 4471 - Class 1 Panel Roof; Factory Mutual Research Corporation.
M. UL 263 - Fire Tests of Building Constructions and Materials.
N. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.
O. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.
P. UL 1897 - Uplift Test for Roof Covering Systems.
Q. SMACNA - Architectural Sheet Metal Manual.
R. National Coil Coating Association (NCCA)
S. NRCA - The NRCA Roofing and Waterproofing Manual.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Standing Seam Roofing System: R-Mer Loc
1. Thermal Expansion and Contraction:
a. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
b. Design temperature differential shall be not less than 200 degrees F.
c. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
d. Location of metal roofing rigid connector shall be at roof ridge unless otherwise approved by the Architect. Metal ridge connector may require design as per job conditions by specified manufacturer.
e. ASTM E 1592: Shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.
f. Underwriters' Laboratories, Inc., (UL), wind uplift resistance classification: Roof assembly shall be classified as Class 1-90, as defined by UL 580
2. Underwriters' Laboratories, Inc., (UL):
a. Underwriters' Laboratories, Inc., (UL) fire resistance P ratings for roof assemblies: If applicable, panel system shall be approved for use in an appropriate Construction Assembly, as defined by UL 263.
b. Underwriters' Laboratories, Inc., (UL) Class A fire rating per UL 790.
3. ASTM E 1680: Static pressure air infiltration (roof panels):
a. Pressure Leakage Rate
1) 1.57 PSF 0.0054 cfm/sq.ft.
2) 6.24 PSF 0.0054 cfm/sq.ft.
3) 20.0 PSF 0.0027 cfm/sq.ft.
4. ASTM E 1646: Static pressure water infiltration (roof panels):
a. Pressure Result:
1) 5 Gal/Hr per S.F. and Static No Leakage
2) Pressure of 20.0 Psf. for 15 minutes
5. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range is not acceptable.
6. Submit third party validation of environmental claims, prepared UL Environment, for all metal roof panels containing recycled content and/or bio based content.

1.5 SUBMITTALS

A. Product Data: Submit product data, test reports, and certifications in accordance with quality assurance and performance requirements specified herein.

B. Design Loads: Submit manufacturer's minimum design load calculations according to ASCE 7, Method 2 for Components and Cladding. In no case shall the design loads be taken to be less than those specified herein.

C. Shop Drawings: Approve District supplied manufacturer shop drawings specifically for this project; Provide comments if needed regarding metal products, details, and accessories, fastening details and connections and interface with other products. Make comments as necessary prior to starting the project.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of installed roof system.
   2. Provide executed copy of manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.

B. Installer Qualifications: Certified and approved installer of the sheet metal roofing manufacturer.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two weeks before scheduled commencement of roofing system installation and associated work.

B. Require attendance of installers of deck or substrate construction to receive roofing, installers of rooftop units and other work in and around roofing which must precede or follow roofing work including mechanical work, Architect, Owner, roofing system manufacturer's representative.

C. Objectives include:
   1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
   2. Tour representative areas of roofing substrates, inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work.
   3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
   4. Review roofing system requirements, Drawings, Specifications and other Contract Documents.
   5. Review and finalize schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
   6. Review required inspection, testing, certifying procedures.
   7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
   8. Record conference including decisions and agreements reached. Furnish a copy of records to each party attending.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with

identification labels intact.

B. Contractor responsible to receive materials from Garland, unload delivery trucks and sign for proper quantities and ensure there are no damaged or missing materials upon delivery. Contractor is responsible to safely protect and stage materials on site. Any thefts or damages to materials will be the responsibility of the contractor.

C. Contractor responsible to secure any District supplied materials in contractor supplied enclosed containers which must be locked at night.

D. Stack pre-finished materials to prevent twisting, bending, abrasion and denting and elevate one end to facilitate moisture run-off.

E. Unload metal panels using a boom or crane, supporting the panels in at least two locations during lifting, and never lift more than three panels at a time

F. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
   1. Store materials above ground, on skids.
   2. Protect material with waterproof covering and allow sufficient ventilation to prevent condensation buildup or moisture entrapment on the materials.

1.9 PROJECT CONDITIONS

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

1.10 WARRANTY

A. Warranty:
   1. 30 year limited watertight warranty for roofs over a 3:12 slope.
   2. Provide installers 5 year warranty covering roofing system installation and water-tightness.

1.11 MANUFACTURER'S INSPECTIONS

A. When the Project is in progress, the roofing system manufacturer will provide the following:
   1. Report progress and quality of the work as observed.
   2. Provide job site inspections three days per week for a minimum of one hour each day. Provide photographic reports for each inspection day directly to the owner.
   3. Report to the Owner in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
   4. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

PART 2 PRODUCTS

2.1 PRODUCTS – GENERAL

A. A list of District supplied materials are indicated at the end of this specification section.

2.2 MANUFACTURERS

A. The CMAS materials and project design is based upon roofing systems engineered and manufactured by The Garland Company. Contact local reps: Peter Cochran 949-295-0447.

B. All metal panels and flat sheets to be provided by the district. List of materials provided by the district on the back of this specification. All materials not listed will be provided by the contractor.

2.3 STANDING SEAM METAL ROOFING

A. R-Mer Loc: Panel with 1-3/4 inch high standing seam with 3/8-inch high clearance between panel and substrate.
   1. Width of Panel:
      a. 16 inches.
   2. Seam Height: 1-3/4 inch.
   3. Slope: Open Purlins, Slopes down to 3:12.
   4. Slope: Solid Substrate, no framing components, Slopes down to 1-1/2 :12.
   5. Panel Clips: Minimum 18 gauge, galvanized steel or stainless steel. Two-piece clips are unacceptable.
   6. Passes:
      a. ASTM E 1592
      b. ASTM E 1680
      c. ASTM E 1646
      d. Class A Fire Rating, UL-790.
      e. UL (Class 90) 580.
   7. Panel material:
      a. Galvanized steel 22 gauge, G90, smooth as per ASTM A 653.
   8. Flashing and flat stock material: Fabricate in profiles indicated on Drawings of same material, thickness, and finish as roof system, unless indicated otherwise.
   9. Coated Finish:
      a. Exposed surfaces for coated panels:
         1) Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
      b. Unexposed surfaces for coated panels shall be baked-on polyester coating with .20 to .30 dry film thickness (TDF).
   10. Accessory Components:
      a. Gable anchor clips shall be minimum 18 gauge, galvanized steel or stainless steel.
      b. Fasteners:
         1) Concealed fasteners: Corrosion resistant steel fasteners (zinc plated or equal) designed to meet structural loading requirements. Provide #14 as minimum fastener size.
         2) Exposed fasteners: Series 410 stainless steel fasteners or one-eighth (1/8) inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the standing seam panels.
      c. Closures: Factory precut closed cell foam meeting ASTM D 1056 or ASTM D 3575, with metal trim matching panels when used at hip, ridge, jamb, and rake.
      d. Provide all miscellaneous accessories for complete installation.

2.4 STANDING SEAM METAL ROOFING ACCESSORIES

A. Underlayment:
   1. R-Mer Seal: 45 mil minimum high temp self adhesive membrane, installed in accordance with manufacturer's recommendations.

B. Sealant:
   1. Concealed Applications: Non-Curing Butyl Sealant - Schnee-Morehead, Inc. SM5430 Acryl-R, or equal.
   2. Exposed Applications: UV Resistant Tripolymer Sealant.

2.5 METAL ROOFING ACCESSORIES

A. R-Mer SS Sheet Stock: High gloss, factory painted aluminum
   1. Material and Thickness:
      a. 22 gauge steel
   2. Color: Colonial Red

2.6 COLOR OPTIONS

A. Standard collection as specified by the contract documents

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive metal roofing. Notify the Architect in writing of any defective conditions encountered. Starting of work shall constitute acceptance of such conditions.

B. Structural Deck Substrate:
   1. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped.
   2. Verify deck is dry and joints are solidly supported and fastened.
   3. Verify wood nailers are installed and correctly located. Do not use pressure-treated wood containing salt-based preservatives or materials corrosive to steel.

C. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.

3.2 INSTALLATION

A. Install in conformance with the NRCA Roofing and Waterproofing Manual and Manufacturers installation requirements.

B. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.

C. Install underlayment and eave protection sheet underlayment as recommended by the Manufacturer.

D. Where not otherwise indicated conform to SMACNA details including flashings and trim.

E. Install sealants where indicated to clean dry surfaces only without skips or voids.

F. Install metal edge treatment in accordance with the manufacturer's instructions and the approved shop drawings.

G. Install metal roofing accessories in accordance with the manufacturer's instructions and the approved shop drawings.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.4 OWNER SUPPLIED MATERIALS

A. Contractor must provide all labor to install owner supplied materials as part of their bid. All materials not specifically included in the owner supplied materials section will be the

responsibility of the contractor. Contractor responsible for any equipment required to load materials from truck onto roof of each site, including but not limited to required cranes and safety requirements.

B. List of Owner supplied materials and quantities.

C. Contractor is responsible to purchase all materials necessary to install project that are not listed below, which include all fasteners, clips, and manufacturer required accessories. Contract Garland for a complete list of contractor supplied materials and pricing to be included in contractor's bid.

Product	Size of each	
R-Mer-Lock 22ga	16" panel	
R-Mer Seal underlayment	200 sq. ft. roll	
R-Mer Flat Stock, 22 ga	4'x10' sheet	
Al-Sil Sealant	10.3 oz./Tube	
Butyl Sealant tape	Case 12	
Tuff-Stuff MS True White	10.3 oz./Tube	

END OF SECTION

SECTION 075216

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Providing labor, equipment, and materials to install specified tapered insulation, flashings for an owner supplied OFCI, CMAS, hybrid KEE Cap sheet and torch base ply roofing system over properly prepared and approved substrate.

1.02 REFERENCES

A. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
   1. ASCE/SEI 7-16 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

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 1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   3. ASTM D 451 – Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
   4. ASTM D 1079 – Standard Terminology Relating, to Roofing, Waterproofing and Bituminous Materials.
   5. ASTM D 1227 – Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
   6. ASTM D 1863 – Standard Specification tor Mineral Aggregate Used as a Protective Coating for Roofing.
   7. ASTM D 4S86 – Standard Specification for Asphalt Roof Cement.
   8. ASTM D 2824 – Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.
   9. ASTM D 5147 – Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
   10. ASTM D 6162 – Standard Specification tor Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
   11. ASTM D 6163 – Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
   12. ASTM E 108 - Standard Test Methods for Fire Test of Roof Coverings.

C. Factory Mutual Global (FMG):
   1. FM Approval 4435 – Approval Standard for Edge Systems Used with Low Slope Roofing Systems.
   2. FM Approval 4470 – Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction.

D. National Roofing Contractors Association (NRCA):
   1. NRCA Roofing Manual.

E. 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.

F. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

1.03 QUALITY ASSURANCE

A. Roofing Installer Qualifications:
   1. Roofing installer specializing in modified bituminous roof application with minimum 10 years experience.
   2. Provide proof of certification to install manufacturer's roofing system within the past three years.
   3. Installer shall provide a current, signed and dated letter signed by a Garland Representative with Bid, stating such roofing installer is a certified installer in good standing and approved to install roofing system on this specific project at Norwalk HS Gymnasium.

B. Roofing Installer's Field Supervision:
   1. Require roofing installer to maintain full-time Supervisor/Foreman on Project Site during installation of bituminous membrane roofing work.
   2. Maintain proper supervision of workmen while roofing work is in progress.
   3. Supervisor/Foremen shall be in possession of copy of roofing specification and be made available on roof.

C. Contractor and roofing installer's responsibility to protect exposed buildings affected by roofing activities from possible weather damages, until completion of roofing work

D. Disqualification of Bidders:
   1. Bidder may be disqualified by Owner for one or more reasons as indicated in Division 00 General Conditions.

E. Roofing Pre-installation Meeting:
   1. Before scheduled commencement of roof system installation and associated work, convene meeting at Project Site with installer of each component of associated Work:
      a. Installer of deck or substrate construction to receive roofing work
      b. Installer of rooftop units and other work where roofing must precede or follow roofing work, including mechanical work.
      c. Owner and Architect.
      d. Roofing system manufacturer's representative.
      e. Other representatives directly concerned with performance of Work, including, where applicable, testing agencies and authorities having jurisdiction.
   2. Objectives to be reviewed include:
      a. Foreseeable methods and procedures related to roofing work.
      b. Tour representative areas of roofing substrates/decks.

1) Inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades.

c. Structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.

d. Roofing system requirements as indicated in Drawings, Specifications, and other contract documents.

e. Required submittals both completed and yet to be completed.

f. Finalize construction schedule related to roofing work and verify availability of material.
   1) Ensure the installer's personnel, equipment and facilities are sufficient to make progress and avoid delays.

g. Required inspection, testing, certifying, and material usage accounting procedures.

h. Weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
   1) Notification procedures for weather or non-working days.

i. Record discussion of meeting including decisions and agreements or disagreements reached and furnish copy of record to each party attending.
   1) Should substantial disagreements exist at the conclusion of the conference, determine how disagreements will be resolved and set date for reconvening conference.

1.04 SUBMITTALS

A. Prepare and provide complete submittal package consisting of:
   1. Required documents such as, but not limited to installer's qualifications, Shop Drawings, and warranties.
      a. Requests for substitutions are subject to review according to General Conditions.
      b. Should substitution be approved, substitution material must conform to required Submittals.

B. Product Data:
   1. Roofing system manufacturer's product data for products necessary for completion of roofing system.
      a. Include roofing system manufacturer's technical product data, installation instructions, and recommendations for each type of roofing product required.
      b. Include data substantiating that materials comply with minimum specified requirements.

C. Test Data and Certifications:
   1. Independent test data that indicates cap sheet complies with Cool Roof Rating Council (CRRC) and Title 24 Energy Standards requirements.
   2. Manufacturer's Certificate: Certified copy of roofing system manufacturer's ISO 9001 compliance certificate.

D. Installer Qualifications:
   1. Installers of specified roofing system must submit a letter from manufacturer that they are approved to install the specified roofing system for specific Project at Norwalk HS. The letter must be dated and signed by a Garland representative.

E. Samples:
   1. Samples of materials necessary for completion of roofing system.

F. Warranty:
   1. Unexecuted Manufacturer's Thirty-Year High-Performance No Dollar Limit (NDL) warranty covering labor and materials.
   2. Roofing contractor/installer to provide roofing manufacturer's version of five years labor warranty template to roofing system manufacturer and Owner.

1.05 SYSTEM DESCRIPTION

A. Roof Deck:
   1. Deck:
      a. Adhere engineered tapered polyisocyanurate insulation to deck with roofing manufacturer supplied insulation adhesive and/or mechanical fasteners.
      b. Install specified tapered insulation with polyisocyanurate insulation to ensure positive drain flow.
      c. Adhere 1/4 dens-deck prime to insulation complying with FM 1-90.

B. Roofing Membrane Installation:
   1. Apply 100 Mil – HPR Torch-Base
   2. Apply 60 Mil – KEE Stone Fleeced back membrane on field set in KEE foam adhesive and KEE Non-FB flashing as directed by manufacturers details.
   3. Apply KEE Stone Unreinforced utility roll and flashing membrane for details and vertical application per manufacturer requirements.
   4. Sheet metal to be ANSI SPRI ES-1 compliant where show on drawings related to roofing contractor scope of work.
      a. Form sheet metal from 22-gauge, coil coated G-90 galvanized steel.
         1) R-MER Flat Stock or R-Mer clad metal
         2) Color to match the finish of composite metal panels as specified in Section 05 0513.
   5. Use of pitch pockets is not permitted.
   6. Membrane manufacturer supplied KEE pipe flashings, storm collars.
   7. All metal equipment flashings to receive ½" primed dens deck insulation board prior to any roofing installation.
   8. All conduits are placed on rubber blocking.
   9. Contractor to be responsible for any ponding water. Contractor to ensure positive drainage.

C. Roofing Membrane Installation:
   1. Roofing contractor shall inspect and approve decking prior to application of insulation and roofing plies.
   2. Contractor shall install tapered insulation indicated on drawings and ensure positive drainage. Any possible ponding sections shall be brought to the attention of owner prior to completion of insulation installation.
   3. Apply Torch SBS-modified base sheet to dens-deck prime.
   4. Install KEE Stone fleece-back cap sheet in specified KEE foam adhesive.
   5. Install KEE Stone flashing and utility roll as specified and required by manufacturer.
   6. Flashing Detail: Base flashing ply to extend 6" onto the roof field. Cap sheet flashing ply to extend 9" onto the roof field. All flashing plies to be

terminated with termination bar set in butyl tape and sealed with caulking. Termination bar to be fastened every 6” o.c.

7. Where applicable: All sheet metal to be ANSI SPRI ES-1 compliant. Sheet metal to be formed from RMER SS Flat Stock. District to determine color.
8. Install new 22 gauge, Kynar edge metal where existing – RMER SS Flat Stock.
9. Install new 22 gauge, Kynar gutters where existing – RMER SS Flat Stock.
10. Install new 22-gauge, galvanized counterflashing. install new, 22-gauge, galvanized skirt metal to the metal flashing. Caulk above counterflashing.
11. No pitch pockets on roof. Fluid applied flashing all penetrations with storm collar covers.
12. All metal equipment flashings to receive ½” insulation board prior to any roofing installation.
13. All conduit, pipe support or roof top conditions to be placed on rubber blocking as specified.
14. Contractor to be responsible for any ponding water. Contractor to ensure positive drainage.

1.06 PROJECT CONDITIONS

A. Weather Condition Limitations: Do not apply roofing membrane during inclement weather or when 40 percent change of precipitation is expected.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

E. Slopes greater than 2:12 require back-nailing to prevent slippage of ply sheets.
1. Use ring or spiral-shank one inch cap nails, or screws and plates at rate of one fastener per ply, including membrane, at each insulation stop.
2. When slope exceeds 2:12, install plies parallel to slope to facilitate back nailing.
3. Install four additional fasteners at upper edge of membrane when strapping plies.

F. Application Conditions:
1. Take precautions when applying materials with spray equipment, to prevent over spray and solvents from damaging or defacing surrounding walls, building surfaces, vehicles or other property.
    a. Exercise care to do following:
        1) Close air intakes into building.
    b. Post and enforce "No Smoking" signs.
2. Avoid inhaling spray mist.
    a. Take precautions to ensure adequate ventilation.
3. Protect completed roof sections from foot traffic for a period of at least 24 to 48 hours at 75 degrees F and 50 percent relative humidity, or until fully cured.
4. Minimum temperature for application is 40 degrees F and rising.

G. Maintain ABC-rated dry chemical fire extinguishers in locations per Cal/OSHA requirements.
   1. Make workers aware of locations and how to properly operate extinguishers.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Roofing installer is responsible for OFCI materials upon delivery.
   1. Lost or stolen material must be replaced by a roofing installer.
   2. Owner is absolved of liability in regard to material delivery or material storage.
   3. Owner may elect to not store material on their property and have roofing installer store material at third party insured storage area in accordance with requirements of Division 00 General Conditions.

B. Store materials at room temperature until immediately prior to application.
   1. Discontinue application when material cannot be stored at temperature, which permits even distribution during application

C. Store and handle roofing sheets in dry, well-ventilated, weather-tight place to ensure no possibility of significant moisture exposure.
   1. Store rolls of felt and other sheet materials on pallets or other raised surfaces.
   2. Stand roll materials on end.
   3. Cover roll goods with canvas tarpaulin or other breathable material
      a. Do not use polyethylene.

D. Do not leave unused materials on roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.

E. Responsibility of roofing installer to secure material and equipment on Project Site.
   1. Should material or equipment be stored on roof, roofing installer must make sure that integrity of roof deck is not compromised.
   2. Damage to roof deck caused by roofing installer will be sole responsibility of roofing installer and will be repaired or replaced at his expense.
   3. If the District elects, all material must be stored by the roofing contractor on school property at no expense to the District.

1.08 INSPECTION AND COORDINATION

A. Comply with roofing inspector’s requirements as provided by roofing system manufacturer.
   1. Is roofing installer’s responsibility to keep roofing inspector, Project Inspector, Architect, and Owner informed regarding issues and concerns.

1.09 SEQUENCING AND SCHEDULING

A. Roofing installer is responsible for coordinating material ordering and delivery with roofing system manufacturer.

B. Sequence installation of modified bituminous sheet roofing with related units of work specified in other sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealants are protected against damage from effects of weather, corrosion and adjacent construction activity.

C. Work must be fully completed each day.
   1. Phased construction is not acceptable.
   2. Phased construction is defined as cap sheet not being applied over installed base sheet within same 12-hour workday.

1.10 WARRANTY

A. Upon completion of Project, installing contractor shall provide following:
   1. Minimum five-year labor warranty to Owner and roofing system manufacturer at no charge.
   2. Executed roofing system manufacturer Thirty Year High-Performance No Dollar Limit (NDL) warranty covering labor and materials.

B. Roofing installer to submit minimum five-year warranty to roofing system manufacturer with copy directly to Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. Basis-of-Design: Design of roofing system is based upon roofing systems engineered and manufactured by The Garland Company, Cleveland, OH or equal.
   1. Peter Cochran 949.295.0447; pcochran@garlandind.com
   2. Upon signature of delivery, roofing installer assumes full responsibility for all staged roof materials.
   3. Replacement of materials lost or stolen are the responsibility of roofing installer.
      a. Roofing installer is responsible for freight and tax on replaced materials.

2.02 MEMBRANE MATERIALS

A. Modified Base Sheet:
   1. HPR Torch Base complying with ASTM D 6163 Type III Grade G
   2. Performance Characteristics:
      a. Tensile Strength, ASTM D 5147: 2 in/min. at 73.4 ±3.6 degrees FMD 100 lbf/inXD 100lbf/in
      b. Tear Strength, ASTM D 5147: 2 in/min. at 73.4 ±3.6 degrees F MD 110 lbf XD 110 lbf
      c. Elongation at Maximum Tensile, ASTM D 5147: 2 in/min. @ 73.4 ±3.6°F MD 2.5 percentage XD 2.5 percentage
      d. Low Temperature Flexibility, ASTM D 5147: Passes -30 degrees F

B. Modified KEE Stone 60 mil Cap Sheet:
   1. Performance characteristics:

      a. Thickness, min. (ASTM D 751) 0.060 in. (1.5 mm)

      b. Thickness over fiber, min. 0.030 in. (0.762 mm),

      c. Breaking Strength (ASTM D 751, proc. B - strip) 375 lbf (1668N)

d. *Breaking Strength, strip >90% of original Elongation at Break (ASTM D 751, proc. B - strip) 40%

e. *Elongation at Break, strip >90% of original Low Temperature Bend after heat aging (ASTM D 2136) -40˚F (-40˚C)

f. Tearing Strength (ASTM D 751) 120 lbf. min. (534N)

g. Low Temperature Bend (ASTM D 2136) -40˚F (-40 ˚C)

h. Static Puncture Resistance (ASTM D 5602) pass

i. Puncture Resistance (ASTM D 751) 161 lbs

j. Factory Seam Strength (ASTM D 751, Grab Method) 620 lbf.

2.04 ROOF INSULATION

A. General:
   1. Provide preformed roof insulation boards for taper design system as specified and shown on construction documents.
   2. Contractor responsible for verifying dimensions of deck, equipment perimeter section, elevations and drains locations and submit a taper design shop drawing.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain.

E. Provide glass mat faced gypsum roof board on top of taper system to accept torch applied roofing system.

2.05 INSULATION ACCESSORIES

A. General:
   1. Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

   2. Insulock insulation adhesive as recommended and supplied by membrane materials manufacturer per installation requirements.

2.06 GLASS MAT ROOF BOARD

A. Glass mat faced gypsum panel, Dens-deck primer or equal, with water-resistant core.
   1. Roof board with nonasphaltic, highly filled proprietary heat-cured integrated coating on one side, for application of concrete roofing tile over plywood deck, complying with applicable properties of ASTM C 1177 and following physical properties:
      a. Nominal Thickness: 1/4 inch ±1/32 inch
      b. Standard Sizes: 4 ft ±1/8 inch wide by 4 ft or 8 ft ±1/4 inch long
      c. Nominal Weight: 1.0 lbs./sq. ft.
      d. Flute Spanability (ASTM E 661): 5 inches

e. Permeance (ASTM E 96, dry cup method): greater than 23 Perms
f. R Value (ASTM C 518, heat flow meter): 0.56 ft^2•°F•hr/BTU
g. Water Absorption (ASTM C 473): less than 10.0 percent maximum
h. Compressive Strength: 900 psi nominal
i. Surface Water Absorption: less than 2.0 grams
j . Fire Classifications:
    1) FM 4450, Class 1
    2) UL 790, Class A
    3) UL 1256
k. Surface Burning Characteristics (ASTM E 84):
    1) Flame Spread Index: 0
    2) Smoke Developed Index: 0

B. Provide glass mat roof board where modified bituminous membrane roof is indicated to be installed over roof insulation.

C. Product and Manufacturer:
    1. Dens-Deck Prime Roof Board by G-P Gypsum, or approved equal.

2.07 RELATED MATERIALS

A. KEE Stone Foam Adhesive – Low rise adhesive foam used to install approved primed insulation boards to KEE Fleece back membrane.

B. Walkway Pads: Approved and supplied by manufacturer as traffic pad for foot traffic and acceptable to roofing system manufacturer.
    1. Pad Size: 36 inches wide, length cut as needed.
    2. Walkway Pad Adhesive: Adhesive to adhere approved walkway pads.
        a. As recommended and furnished by roofing system manufacturer.
        b. Complying with SCAQMD Rule 1168.

C. Sheet Metal Flashing:
    1. Refer to materials and requirements specified in Section 07 6200 for sheet metal flashing materials and installation.

D. Butyl Tape: 100 percent solids, asbestos free, compressive tape designed to seal as recommended and furnished by membrane manufacturer.
    1. Butyl tape is required at terminations.

E. Sealant: *Tuff-Stuff MS,* moisture curing, single component polymer sealant, *as needed.*
    1. Comply with the requirements of Section 07 9200 and SCAQMD Rule 1168.

F. KEE White Urethane Mastic by Membrane Manufacturer.

G. Insul-lock insulation adhesive for installation of tapered insulation system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine and approve substrate surfaces to receive modified bitumen torch applied base sheet and KEE Stone Cap sheet, and associated work and

conditions under which roofing will be installed prior to installing insulation and roofing plies.

B. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to owner and roofing system manufacturer's representative, roofing installer, and Project Inspector.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with roofing system manufacturer's representative and inspection and testing agencies engaged or required to perform services in connection with installing roof system.

B. Insurance/Code Compliance: Where required, install and test roofing system to comply with governing regulation and specified insurance requirements.

C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors.
   1. Replace or restore other work damaged by installations of modified bituminous roofing system Work.

D. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight.

E. Cut-Offs: Provide cut-offs at the end of each day's work to cover exposed ply sheets and insulation.
   1. Provide temporary covering of torch base with joints and edges sealed or other jointly agreed upon tie-in detail.
   2. Remove cut-offs immediately before resuming work.

F. Substrate Joint Penetrations: Prevent bitumen and/or specified adhesives from penetrating substrate joints, entering building, exterior drippage or damaging roofing system components.

G. Apply roofing materials as specified herein unless recommended otherwise by roofing system manufacturer's instructions.
   1. Keep roofing materials dry before and during application.
   2. Do not permit phased construction.
   3. Complete application of roofing plies, modified sheet and flashing in continuous operation.
   4. Begin and apply only as much roofing in one day as can be completed that same day.

H. Keep ABC rated tire extinguisher in location per Cal/OSHA requirements.
   1. Make workers aware of its location how to operate it properly.

3.03 APPLICATION PROCEDURE TORCH APPLIED INSTALLATION

A. Roof installation:
   1. Base Ply Installation:
      a. Install one ply of HPR Torch base shingled uniformly over entire prepared substrate.
         1) Shingle in direction of slope of roof to shed water on each area of roof.
      b. Lap ply sheet ends eight inches.
         1) Stagger end laps twelve inches minimum.

c. Extend ply two inches beyond top edges of cants at wall and roof projections and equipment bases.
d. Install base flashing ply to perimeter and projection details.

2. KEE Stone Installation:
   a. Fully Adhere KEE FB membrane in ribbon laid KEE adhesive, heat weld seams as required by manufacturer.
   b. Starting at low point, unroll membrane in desired position.
   c. Install subsequent rolls of membrane across roof as above with minimum of four inch side laps and eight inch end laps.
      1) Stagger end laps.
   d. Apply membrane in same direction as previous layer but stagger laps so they do not coincide with laps of base layers.
      1) Allow 5-10 minutes to flash, then join two surfaces and using small metal roller or other suitable roller, firmly press into place.
      2) Roll edges firmly to ensure positive adhesion. .

3. Flashing Membrane Application:
   a. Seal curb, wall and parapet flashings with kee membrane flashing/kee flashing adhesive.
      1) Do not permit conditions to exist that will allow moisture to enter behind, around or under roof or flashing membrane.
   b. Use KEE Stone flashing membrane and unreinforced utility roll for flashing details.
      1) Nail off at minimum of eight inches on center from finished roof at vertical surfaces.
   c. Solidly adhere the entire sheet of flashing membrane to substrate.
      1) Secure tops of flashings that are not run up and over curb through termination bar 6 inches and sealed at top.
   d. Seal vertical laps of flashing membrane.
   e. Details:
      1) Comply with manufacturer's installation details.
      2) Extend Base flashing ply 6 inches onto roof field.
      3) Extend Cap Sheet Flashing Ply 9 inches onto roof field.

3.04 SHEET METAL FLASHING AND TRIM INSTALLATION

A. Comply with requirements or related sections for flashing materials and installation requirements and as follows:
   1. Prefabricated, prefinished sheet metal for coping cap, counter flashing, edge metal, and skirt flashing details, except where stainless steel is indicated.
   2. Fascia Cover: Tie into edge metal and lap over end of fascia board at 2 inches minimum.
   3. Gutters: Where indicated.
   4. Stainless steel flashings at penetration points.
      a. Umbrella cover for stainless steel flashings.

B. Crickets: Install cricket on the high side of mechanical units.
   1. Roofing installer is responsible for positive drainage of water.
   2. Terminate flashing with termination bar set in butyl tape on HVAC units / curbs.
      a. Install 22 gauge, galvanized, coil coated metal counterflashing.

C. Place new and existing conduit on rubber block supports.

D. Seal equipment with specified Title 24 coating.
   1. Apply at 2 gallons per square.

E. Seal duct work seams and corners with three course application of Flashing Bond and Mesh.

F. Splash Blocks: Install splash blocks in locations shown on Drawings.

3.05 FIELD QUALITY CONTROL

A. Require attendance of roofing system manufacturer's representatives at Project Site during installation of roofing system.
   1. Roofing system manufacturer's roofing inspector is required to sign off on roofing scope of work indicated in Article 1.05 B.

B. Roofing System Manufacture's Responsibilities:
   1. While roofing work is in progress, roofing system manufacturer will provide inspections in accordance with following:
      a. Perform Project Site inspections for minimum of three days per week.
      b. Keep Owner and Architect informed as to progress and quality of Work as observed.
      c. Report to Owner and Architect, in writing, failure or refusal of roofing installer to correct unacceptable practices called to roofing installer's attention.

Roofing Installer's Responsibilities:
   1. Comply with requirements of Roofing Inspector provided by roofing system manufacturer.
   2. Keep Roofing Inspector, Project Inspector, Architect, and Owner informed regarding issues and concerns.
   3. Confirm after completion that manufacturer has observed no application procedures in conflict with specifications other than those that may have been previously reported and corrected.

3.06 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with roofing installer, installer of associated work, Owner, Architect, roofing system manufacturer's representative and other representatives directly concerned with performance of roofing system.

B. Inspect roof surface areas of building, including perimeter building edges, flashing of roof penetrations, walls, curbs and other equipment.
   1. List items requiring correction or completion and furnish copy of list to each parting attending.

C. Owner reserves right to request thermographic scan of roof during final inspection to determine if damp or wet materials have been installed.
   1. Should defects be discovered, roofing installer shall correct and fix defective areas at no charge to Owner.

D. Should core cuts verify presence of damp or wet materials, roofing installer shall be required to replace damaged areas at his own expense.

E. Repair or replace, as required, deteriorated or defective work found at time above inspection, to condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. Roofing installer is to notify Owner upon completion of corrections.

G. Following final inspection, acceptance will be made in writing by roofing system manufacturer.
   1. Roofing installer shall provide needed coordination for providing such approval.

H. Comply with specified closeout procedures in Section 01 7700.

3.07 CLEANING

A. Remove drippage of bitumen from walls, windows, floors, ladders and finished surfaces.

B. In areas where finished surfaces are soiled by asphalt or other sources of soiling caused by roofing work, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

C. At the end of installation, contractor is responsible to wash and clean finished roofing system prior to final punch-walk, resulting in a clean, white and debris free finished final ply.

D. Roofing installer is not to use Owner's rubbish bins.
   1. Remove used material containers and dispose of off Project Site.
   2. Comply with requirements of Section 01 7419.

END OF SECTION 075216

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet metal flashing and trim not specifically specified in other sections.
   2. Gutters and downspouts.

B. Related Sections:
   1. Division 9 Section “Painting” for painting of sheet metal flashing and trim.

1.2 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
   6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
   7. Details of special conditions.
   8. Details of connections to adjoining work.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheet metal flashing and trim that fails in materials or workmanship within specified warranty period.
   1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Galvanized Sheet Metal Flashing and Trim:
   1. Fry Reglet Corporation.
   2. Hickman, W. P. Company.
   3. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
   4. Or equal.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
   1. Fabricate from the following materials:
      a. Match finish and color of Division 7 Section “Metal Wall Panels”.

B. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Fabricate from the following materials:
      a. Match finish and color of Division 7 Section “Metal Wall Panels”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Coat back side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped 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 sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as shown and as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

G. Flashing corners shall be shop fabricated and fully soldered such that corner assemblies are single monolithic units for 18" in all directions from corners.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Loosely lock straps to front gutter bead and anchor to roof deck.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
   2. Connect downspouts to underground drainage system indicated.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Loosely lock straps to front gutter bead and anchor to roof deck.
   3. Anchor and loosely lock back edge of gutter to continuous cleat.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
   2. Connect downspouts to underground drainage system indicated.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 076500 - FLEXIBLE SHEET FLASHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Flexible sheet flashing for windows, doors, parapets, and other openings and where indicated on Drawings.

1.2 SUBMITTALS

A. Concurrent Review Requirements: Submit submittals of this section with doors and windows sections.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of flexible sheet flashing.

C. Shop Drawings: Show locations and extent of flexible sheet flashing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For the following products:
   1. 12-by-12-inch square of flexible sheet flashing.

E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for flexible sheet flashing.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is acceptable to flexible sheet flashing manufacturer for installation of flexible sheet flashing required for this Project.

B. Source Limitations: Obtain flexible sheet flashing materials through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by flexible sheet flashing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of flexible sheet flashing that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flexible Sheet Flashing: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. WR Grace (Basis of Design).
   2. FortiFlash by Fortifiber.
   3. FlexWrap and StraightFlash by DuPont.
   4. Or equal.

2.2 FLEXIBLE SHEET FLASHING

A. Product: Vycor Plus by WR Grace or equal.
   1. Self-Adhered, cross-laminated high-density polyethylene (HDPE) sheet, backed by aggressive pressure-sensitive rubberized asphalt adhesive.
   2. Thickness: 25 mil minimum per ASTM D3767, Method A.
   3. Low temperature flexibility: Unaffected at minus 45 degrees F. per ASTM D1970.
   4. Elongation, ultimate failure of rubberized asphalt: 200 percent minimum per ASTM D412.
   5. Cracked cycling 100 cycles: Unaffected at minus 25 degrees F. per ASTM C836.
   6. Lap adhesion at minimum application temperature: 60 plf width per ASTM D1876 modified.
   7. Adhesion to concrete at minimum application temperature: 60 plf width per ASTM D903.
   8. ICBO: ER-6141.
   9. Recommended exposure limit: 30 days.
   10. Perm-A-Barrier by Grace is not acceptable.

2.3 AUXILIARY MATERIALS

A. Mastic, Joint Sealant, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by flexible sheet flashing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that concrete has cured and aged for minimum time period recommended by flexible sheet flashing manufacturer.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install flexible sheet flashing in accordance with the manufacturer's written instructions, AAMA Publication 2400, and the applicable code.

END OF SECTION 076500

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Roof curbs.
   2. Roof hatches.

B. Related Sections include the following:
   1. Division 9 Section “Painting” for field finishes.

1.2 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roof accessories that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Roof Curbs: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Custom Curb, Inc.
   2. LM Curbs.
   3. ThyCurb; Div. of Thybar Corporation.
   4. Or equal.

B. Roof Hatches: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. J.L Industries (Activar) (Basis of Design)
   2. Bilco Company (The).
   3. Milcor Inc.; a Gibraltar Company.
   4. Nystrom, Inc.
   5. O'Keeffe's Inc.
   6. ThyCurb; Div of Thybar Corporation.
   7. Or equal.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653, G90 coated and mill phosphatized for field painting.
   1. Comply with Division 9 Section “Painting” for field finishes.

2.3 MISCELLANEOUS MATERIALS

A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

B. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

D. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
   1. Caulking and sealants applied on the interior of the building envelope shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.4 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Material: Galvanized steel sheet, 0.079 inch thick.
      a. Finish: Factory prime painted and field painted per Division 9 Section “Painting”.
   2. Factory insulate curbs with 1-1/2-inch- thick, cellulosic or glass-fiber board insulation.
   3. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
   4. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 ROOF HATCHES

A. General: Fabricate roof hatches with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

B. Product: Diamond Series by JL Industries (Activar) or equal.
   1. Size: Custom size as indicated on Drawings, minimum 30 by 37 inches.
   2. Type: Galvanized 14 gauge paint bond G-90 galvanized steel single or double-leaf lid as indicated on Drawings.
   3. Cover:
      a. 3 inch beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

b. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
c. Operation of the cover shall not be affected by temperature.
d. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

4. Cover insulation: Shall be fiberglass of 1 inch thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.
5. Curb: 12 inch in height with integral capflashing, 1 inch fiberboard insulation, fully welded at corners, and 3-1/2 inch mounting flange with 7/16 inch holes provided for securing frame to the roof deck.
6. Curb insulation: Shall be rigid, high-density fiberboard of 1 inch thickness on outside of curb.
7. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
8. Safety Railing: SHWC - SAF-T-Hatch Rooftop Safety Railing.
   a. Certifications: Meets OSHA required compliance for safe egress and ingress through rooftop hatch openings while hatch is in use. Complies with OSHA CFR 29 - 1910.29. Self-closing Rigid Gate, Grab Bar for 24-35" wide Models.
9. Hardware:
   a. Heavy pintle hinges shall be provided
   b. Cover shall be equipped with a spring latch with interior and exterior turn handles
   c. Roof hatch shall be equipped with interior and exterior padlock hasps.
   d. The latch strike shall be a stamped component bolted to the curb assembly.
   e. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” diameter red vinyl grip handle to permit easy release for closing.
   f. Compression spring tubes shall be Type 316 stainless steel hardware.
   g. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
10. Factory Prime Finish:
    a. Steel: Alkyd base red oxide primer.
11. Field Finish: Comply with Division 9 Section ”Painting”.

2.6 FINISH

A. Galvanized Steel: Field finish per Division 9 Section “Painting”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation:
   1. Set roof curb so top surface of roof curb is level.

F. Roof Hatch Installation:
   1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
   2. Attach ladder safety post according to manufacturer's written instructions.

3.3 TOUCH UP

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, whether indicated on drawings or not, and other openings indicated.

B. Related Sections include the following:
   1. Division 7 Section "Fire-Resistive Joint Systems."
   2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.2 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 walls, 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 ASTM E 814 or 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. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
      a. Penetrations located outside wall cavities.
      b. Penetrations located outside fire-resistance-rated shaft enclosures.
   3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

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.

1.3 SUBMITTALS

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

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. 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.

D. Qualification Data: For Installer.

E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
      a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
         1) UL in its "Fire Resistance Directory."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of through-penetration firestop system that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Through-Penetration Firestop Systems: Subject to compliance with requirements, provide one of the through-penetration firestop systems for each application that are produced by one of the following manufacturers.
   1. Hilti, Inc.
   2. Specified Technologies Inc.
   3. 3M; Fire Protection Products Division.
   4. Or equal.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-/rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.

3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Caulking, sealants, and adhesives applied on the interior of the building envelope shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a

nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
   1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Through-penetration firestop system designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Through-penetration firestop system manufacturer's name.
   6. Installer's name.

B. Marking and Identification: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling or attic spaces.
   2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partitions.
   3. Include lettering not less than 0.5 inch in height, incorporating the suggest wording: “fire and/or smoke barrier – protect all openings,” or other wording.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off 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 damage materials in which openings occur.

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, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM LOCATION

A. Provide assemblies as indicated on Drawings. Provide following products for additional locations not identified on Drawings.

B. For penetrations by non combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant.
2. Hilti FS ONE High Performance Intumescent Firestop Sealant.
3. 3M Fire Stop Sealant 2000 4. 3M Fire Barrier CP25 WB.
4. Tremco Tremstop Fyre Sil Sealant.
5. Or equal.

C. For penetrations by combustible items (penetrants consumed by high heat flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
1. Hilti FS ONE High Performance Intumescent Firestop Sealant.
2. Hilti CP 618 Firestop Putty.
3. Hilti CP 642 Firestop Jacket.
4. Hilti CP 643 Firestop Jacket.
5. 3M Fire Barrier CP25 WB.
6. 3M Fire Barrier FS 195 Wrap/Strip.
7. Tremco Tremstop WBM Intumescent Firestop Sealant.
8. Or equal.

D. For penetrations by combustible plastic pipe (open piping systems), the following materials are acceptable:
   1. Hilti CP 642 Firestop Jacket.
   2. Hilti CP 643 Firestop Jacket.
   3. Hilti FS ONE High Performance Intumescent Firestop Sealant.
   4. 3M Fire Barrier PPO Plastic Pipe Device.
   5. Or equal.

E. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways' the following materials are acceptable:
   1. Hilti FS 635 Trowelable Firestop Compound.
   2. Hilti FIRE BLOCK.
   3. 3M Firestop Foam 2001.
   4. 3M Fire Barrier CS 195 Composite Sheet.
   5. Or equal.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire-resistive joint systems for interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.

B. Related Sections include the following:
   1. Division 7 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
   2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint 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 assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
   1. Load-bearing capabilities as determined by evaluation during the time of test.

C. For fire-resistive 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.

1.3 SUBMITTALS

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

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
      a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
      b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fire-resistive joint systems that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire-Resistive Joint Systems: Subject to compliance with requirements, provide one of the through-penetration firestop systems for each application that are produced by one of the following manufacturers.
   1. Hilti, Inc.
   2. Specified Technologies Inc.
   3. 3M; Fire Protection Products Division.
   4. Or equal.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.

B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
   1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM LOCATION

A. For fire rated construction joints and other gaps, the following materials are acceptable:
   1. FS 601 Elastomeric Firestop Sealant by Hilti.
   2. CP 601 s Elastomeric Firestop Sealant by Hilti.
   3. CP 606 Flexible Firestop Sealant by Hilti.
   4. CP 672 Firestop Joint Spray by Hilti.
   5. Firestop Sealant 2000 by 3M.
   6. Tremstop Fyre Sil Sealant by Tremco.
   7. Or equal.

B. For openings between structurally separate sections of wall and floors. Top of walls, the following materials along with Thermafiber Safing are acceptable:
   1. FS 60t Elastomeric Firestop Sealant by Hilti.
   2. CP 601s Elastomeric Firestop Sealant by Hilti.
   3. CP 606 Flexible Firestop Sealant. by Hilti

4. FS ONE High Performance Intumescent Firestop Sealant by Hilti.
5. Fire Barrier CP 25 WB by 3M.
6. Or equal.

C. Firestopping at Electrical Boxes and Utility Outlets.
1. CP 618 Firestop Putty Stick by Hilti.
2. CP 617 and CP 617L Firestop Putty Pad by Hilti.
3. Or equal.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants.

B. Related Sections:
1. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
2. Division 7 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

E. Qualification Data: For Installer.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years.

B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

C. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Joint Sealants: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Sika Corporation
   2. Pecora Corporation.
   3. Bostik.
   4. Dow Corning Corp.
   5. GE Plastics.
   6. Sonneborn Building Products, ChemRex, Inc.
   7. Tremco, Inc.
   8. The Sherwin-Williams Company.
   9. Or equal.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, 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.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants:
   1. As selected by Architect from manufacturer's full range.
   2. Areas where concrete joint sealant will be adjacent to concrete other than standard gray, sealant color shall match adjacent color as approved by Architect.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form-release agents from concrete.
      a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
   1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
   2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
   3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
   4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT LOCATION

A. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Products:
      a. SikaFlex 1A or 15LM by Sika Corp.
      b. Dynatrol I-XL by Pecora.
      c. Stampede 1 by The Sherwin-Williams Company.
   2. Color: Standard colors matching finished surfaces.
   3. Applications:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.

B. Exterior Metal Lap Joint Sealant: Silicone, Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Products:
      a. SikaSil WS-295 Silicone by Sika Corp.
      b. 895 Silicone or Sil-Span by Pecora.
   2. Color: Standard colors matching finished surfaces.
   3. Applications:
      a. Concealed sealant bead in sheet metal work.
      b. Concealed sealant bead in siding overlaps.

C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
   1. Products:

a. AC-20 manufactured by Pecora.
b. 950A manufactured by The Sherwin-Williams Company.
2. Color: Standard colors matching finished surfaces.
3. Applications:
a. Interior wall and ceiling control joints.
b. Joints between door and window frames and wall surfaces.
c. Other interior joints for which no other type of sealant is indicated.

D. Interior Floor Joint Sealant: Polyurethane, chemically-curing, cold-applied, self-leveling elastomeric sealant; ASTM C 920, Grade P, Class 25, Uses T, M and A; two-part.
1. Products:
a. SikaFlex 2C SL or NS with TG Additive by Sika Corp.
b. NR-200 self-leveling polyurethane and/or DYNATRED non-sag, traffic-grade polyurethane sealants by Pecora.
c. Stampede 2SL by The Sherwin-Williams Company.
2. Primer: SikaFlex 429 Primer; P-150, P-75 or P-200.
3. Color: Standard colors matching finished surfaces.
4. Applications: Use for joints up to 1-1/2 inches.
a. Expansion joints in floors.

E. Concrete Paving Joint Sealant: Polyurethane, chemically-curing, cold-applied, self-leveling elastomeric sealant; ASTM C 920, Class 25, Uses T, I, M and A; two-part.
1. Products:
a. NR-200 Urexpan and/or DYNATRED non-sag, traffic-grade polyurethane sealant by Pecora or equal.
b. Stampede 2NS by The Sherwin-Williams Company.
2. Primer: SikaFlex 429 Primer; P-150, P-75 or P-200.
3. Color: Gray or Limestone.
4. Applications:
a. Joints in sidewalks and vehicular paving.

F. Butyl Sealant: ASTM C 920, Grade NS, Class 12-1/2, Uses NT, M, A, G, O; single component, solvent release, non-skinning, non-sagging.
1. Products:
a. BC-158 sealant by Pecora.
b. WL Silicone Rubber by The Sherwin-Williams Company.
2. Color: Standard colors matching finished surfaces.
3. Movement Capability: Plus and minus 12-1/2 percent.
4. Service Temperature Range: -13 to 180 degrees F.
5. Shore A Hardness Range: 10 to 30.

G. Silicone Sealant: ASTM C 920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
1. Products:
a. SikaSil WS 290 or WS 295 by Sika Corp.
b. 864 LM Architectural silicone or 890 silicone sealant by Pecora.
c. 790 by Dow Corning Corporation.
d. WL Silicone Ultra WL09210.
2. Color: Standard colors matching finished surfaces.
3. Movement Capability: Plus and minus 25 percent.
4. Applications:

a. Interior or exterior for joints 1/8 to 1-1/2 inch wide.
b. Exterior use at expansion joints in masonry where substantial movement is expected.
c. Glazing application.

END OF SECTION 079200

SECTION 081113 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.

B. Related Sections include the following:
   1. Division 8 Section “Door Hardware” for door hardware for hollow metal doors.
   2. Division 9 Section “Painting” for field painting hollow metal doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel doors and frames that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Doors and Frames: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Steelcraft; an Ingersoll-Rand company. (Basis of Design).
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   4. Or equal.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications for interior doors and frames.

B. Galvannealed (Metallic-Coated) Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum A60 metallic coating for exterior doors and frames.

C. Frame Anchors: ASTM A 591, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.

G. Glazing: Comply with requirements in Division 8 Section "Glazing."
1. Wired glass is not allowed.
2. Tempered or fire-rated where required.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
   a. Standard Core: Honeycomb, U-factor of 0.69, R-value of 1.45.
   b. Fire Door Core: As required to provide fire-protection indicated.
3. Vertical Edges for Single-Acting Doors: Beveled edge.
   a. Beveled Edge: 1/8 inch in 2 inches.
4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
7. Vision, Narrow Lite, Half Glass Doors: Size as indicated on Drawings.

B. Exterior Doors: Face sheets fabricated from galvannealed (metallic-coated) steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush):
   a. Face thickness: 16 gage (0.053 inch).
      1) Product: Series L16 by Steelcraft.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless galvanized (metallic-coated) sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush):
   a. Face thickness: 18 gage (0.042 inch).
      1) Product: Series L18 by Steelcraft.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frame: 14 gage (0.067-inch) thick steel sheet.
   a. Product: F14 Series by Steelcraft.

C. Interior Frames: Fabricated from cold-rolled steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded. Knocked down is not allowed.
3. Frame: 16 gage (0.053-inch) thick steel sheet.
   a. Product: F16 Series by Steelcraft.
4. Frames for Wood Doors: Same type as for steel doors.
5. Frames for Borrowed Lights: Same as adjacent door frame.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Provide Screw-In Top Cap for exterior doors.

D. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.7 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances:
1. Standard doors and frames: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
    b. Compression Type: Not less than two anchors in each jamb.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
1. Maximum Rate: 0.3 cfm/sq. ft. of area at an inward test pressure of 1.57 lbf/sq. ft.
2. Maximum Rate: 0.1 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Field-Applied Paint Finish: Comply with Division 9 Section “Painting”.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable glazing stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
      a. Post-installed expansion anchors shall comply with IR 19-1.
      b. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:
   1. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
   2. Division 9 Section “Painting” for field applied finishes.

1.2 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.4 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of access doors and frames that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Doors and Frames: Subject to compliance with requirements, provide products by one of the following:
1. Karp Associates Inc.
2. Acudor.
3. Milcor Inc.
4. Nystrom, Inc.
5. MIFAB.
6. Or equal.

2.2 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.
1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153, for galvanizing steel and iron hardware.

B. Steel Sheet: Cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Factory Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Field Finish: Factory prime for field painting as specified in Division 9 "Painting".

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Recessed Door to Receive Drywall Type:
1. Fire-Rated: Model 450FR by Karp.
2. Non-Fire-Rated: Model RDW by Karp.
3. Frame shall be 14 gage steel and doors shall be 16 gage steel.
4. Door shall be recessed 1 inch.

5. Trim shall be galvanized steel dry wall bead.
6. Hinge shall be concealed pivoting rod type.
7. Locks shall be flush and screwdriver operated with stainless steel cam and studs, or shall be key operated cylinder lock with automatic dust shutter.
8. Finish shall be prime coat of rust inhibitive electrostatic powder, baked grey coat.
9. Door Sizes:
   a. As indicated on Drawings.
10. Field Finish: Comply with Division 9 Section "Painting".

B. Flange Type:
1. Fire-Rated: Model KRP-250 by Karp.
2. Non-Fire-Rated: Model DSC-214M by Karp.
3. Frame shall be 14 gage steel and doors shall be 16 gage steel.
4. Flange: One-piece construction, 3/4 inch wide.
5. Hinge shall be concealed continuous piano hinge.
6. Locks shall be flush and screwdriver operated with stainless steel cam and studs, or shall be key operated cylinder lock with automatic dust shutter.
7. Finish shall be prime coat of rust inhibitive electrostatic powder, baked grey coat.
8. Door Sizes:
   a. As indicated on Drawings.
9. Field Finish: Comply with Division 9 Section "Painting".

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Field finish per Division 9 Section "Painting".

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes aluminum-framed windows.

B. Related Sections include the following:
   1. Division 8 Section "Glazing" for glazing requirements for aluminum windows.

1.2 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
   1. Commercial (C).

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
   1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Weather-stripping details.
   6. Glazing details.

C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

D. Qualification Data: For Installer and manufacturer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements." Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   1. Provide AAMA or WDMA-certified aluminum windows with an attached label.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

H. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
      e. Failure of insulating glass.
   2. Warranty Period:
      a. Window: Two years.
      b. Glazing: Five years.
      c. Metal Finish: Five years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Windows: Subject to compliance with requirements, provide products by one of the following:
   1. Arcadia Windows. (Basis of Design)
   2. EFCO Corporation.
   3. Kawneer; an Alcoa Company.
   4. TRACO.
   5. Wausau Window and Wall Systems.
   6. Or equal.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.062-inch thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
   1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.

F. Replaceable Weather Seals: Comply with AAMA 701/702.

G. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOWS

A. Product: AFG451T by Arcadia or equal.
1. Profile: 2” X 4-1/2”.
2. Glazing: Offset with 1” low e-insulated glass tint to match existing as approved by Architect.

2.4 GLAZING

A. Glass: Insulated glazing. Refer to Division 8 Section "Glazing" for detailed glass and glazing requirements applicable to glazed aluminum window units.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable

if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085113

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

a. Swinging doors.
b. Gates

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors
6. Installation.
7. Rough hardware.
8. Conduit, junction boxes & wiring.
9. Folding partitions, except cylinders where detailed.
10. Sliding aluminum doors, except cylinders where detailed.
11. Access doors and panels, except cylinders where detailed.

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.3 REFERENCES

A. UL - Underwriters Laboratories

1. UL 305 - Panic Hardware

B. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

C. California Code of Regulations

1. Title 24: California Building Standards Code

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

   a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

   a. Door Index; include door number, heading number, and Architects hardware set number.
   b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
   c. Type, style, function, size, and finish of each hardware item.
   d. Name and manufacturer of each item.
   e. Fastenings and other pertinent information.
   f. Location of each hardware set cross-referenced to indications on Drawings.
   g. Explanation of all abbreviations, symbols, and codes contained in schedule.
   h. Mounting locations for hardware.
   i. Door and frame sizes and materials.

j. Name and phone number for local manufacturer's representative for each product.
k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
   1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

   a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
   b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   c. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier and Installer.
2. Product Certificates for electrified door hardware, signed by manufacturer:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

   a. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.

4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Final approved hardware schedule, edited to reflect conditions as-installed.
e. Final keying schedule
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
g. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

H. Means of Egress Doors: Latches do not require more than 5 lbs (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbs (22.2 N).
2. Maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbs (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbs (22.2 N) applied parallel to door at latch.
c. Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 lbs (66.7N).

3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust closer so that the time required to move the door from the 90 degree position to 12 degrees from the latch is 5 seconds minimum.

J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

K. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

a. Attendees: Door hardware supplier, door hardware installer, Contractor.
b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings:

1. 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. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.

2. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.

F. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 30 years.

b. Exit Devices:
1) Mechanical: 3 years.

c. Locksets:
1) Mechanical: 3 years.

d. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.10 REGULATORY REQUIREMENTS:

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per-2022 California Building Code, Section 11B-404.2.7.

1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.

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 the wrist to operate. 2022 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code 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. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

D. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2022 California Building Code Section 11B-404.2.9, Exception 2.

1. Where powered door serves an occupancy of 150 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.
2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2022 California Building Code Section 11B-703.7.
3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2022 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.

E. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.

1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

F. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.

G. 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. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.

1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.

H. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than

0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.

I. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).

J. Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.

K. Door and door hardware encroachment: Doors, when fully open, shall not reduce the required width by more than 7 inches. Doors in any position shall not reduce the required width by more than one-half. 2022 California Building Code, Section 1005.7.1.

1. In I-2 occupancies, surface mounted latch release hardware is not permitted to project in the required egress width, regardless of its mounting height, per 2022 California Building Code, Section 1005.7.1 at Exception 1.

L. In groups I-2 or I-2.1 occupancies, doors serving as a means of egress where used for the movement of beds and stretcher patients shall provide a minimum clear opening width of 44 inches. At pair openings that includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 44 inches. 2022 California Building Code, Section 1010.1.1.

M. In group I-2 or I-2.1 occupancies, there shall be no projections into the clear width of doors used for the movement of beds and stretcher patients in the means of egress. 2022 California Building Code, Section 1010.1.1.1 at Exception 2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturer” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.

6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.
12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.4 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:

    a. Scheduled Manufacturer: Ives.
    b. Acceptable Manufacturers: Markar, Stanley.

2. Requirements:

    a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
    b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
    c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
    d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
    e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
    f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
    g. Install hinges with fasteners supplied by manufacturer.

h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.5 GATE HINGES/CLOSERS

1. Manufacturers and Products:

   a. Schedule Manufacturer and Product: Locinox Mammoth/Tiger Series

2.6 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series
2. Acceptable Manufacturers and Products: Corbin-Russwin ML2000 series, Best 45H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

   a. Lever Design: As scheduled.
   b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.7 AUXILIARY LOCKS

A. Padlocks:

1. Manufacturers and Products:

   a. Scheduled Manufacturer and Product: Schlage KS series
   b. Acceptable Manufacturers and Products: Best 11B series, Master Lock

2. Requirements:

a. Provide padlocks with 1 inch (25 mm) shackle height, unless noted otherwise, as specified. Cylinders: Refer to "KEYING" article, herein.

2.8 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99/33 series
2. Acceptable Manufacturer and Product: Sargent 19-43-GL-80 series, Dorma 9000 Barrier-Free Series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.
10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.
    b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

12. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.

    "AX" feature: touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.

13. Provide UL labeled fire exit hardware for fire rated openings.

14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled.

2.9 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage
2. Acceptable Manufacturers: ASSA, Best, Corbin-Russwin, Medeco, Sargent, Yale

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.10 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:

1. Firm Name: Buena Park USD
2. Contact Person: Kevin Vanderwest
3. Telephone: 1-714-351-1996

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

    a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

    a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
    b. Patent Protection: Keys and blanks protected by one or more utility patent(s).

4. Identification:

    a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
    b. Identification stamping provisions must be approved by the Architect and Owner.

c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

a. Change (Day) Keys: 3 per cylinder/core.
b. Master Keys: 6.

2.11 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturer and Product: Sargent 281 Series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. 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.

2.12 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Rockwood

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

    a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: ABH, Rixson

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: NGP, Pemko

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

   a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
   b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.17 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Rockwood

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.18 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 630 (US32D)
3. Continuous Hinges: BHMA 628 (US28)
4. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
5. Protection Plates: BHMA 630 (US32D)
6. Overhead Stops and Holders: BHMA 630 (US32D)
7. Door Closers: Powder Coat to Match
8. Wall Stops: BHMA 630 (US32D)
9. Latch Protectors: BHMA 630 (US32D)
10. Weatherstripping: Clear Anodized Aluminum
11. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Existing frames and doors to be retrofitted with new hardware:

1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.
3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware’s strike.

4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.

3.2 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

   a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
   b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
   c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

1. Coordination: Coordinate provision with the security systems provider to mitigate excessive or redundant purchase.
2. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

R. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.

S. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.

T. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.

U. Provide manufacturer’s recommended brackets to accommodate the mounting of closers on doors with flush transoms.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Do not order material until submittal has been reviewed, stamped, and signed by Architect’s door hardware consultant.

C. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):
B104B B105A

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	FIRE EXIT HARDWARE	PA-AX-99-L-F-2SI-06	626	VON
2	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A (OR PER SILL DETAIL)	A	ZER
1	EA	FINGER GUARD	51A-180	A	ZER

Hardware Group No. 02

For use on Door #(s):

B100A	B100B	B101A	B101B	B102A	B102B
B103A	B103B	B104A	B105B	B106A	B106B
B110A	B110B	B111A	B111B		

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	MORTISE CYLINDER (DOGGING)	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A (OR PER SILL DETAIL)	A	ZER
1	EA	FINGER GUARD	51A-180	A	ZER

Hardware Group No. 03

For use on Door #(s):

A100A	A100B	B109

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	MORTISE CYLINDER (DOGGING)	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A (OR PER SILL DETAIL)	A	ZER

Hardware Group No. 04

For use on Door #(s):
B108

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A (OR PER SILL DETAIL)	A	ZER

Hardware Group No. 05

For use on Door #(s):
B100C B101C B102C B103C B104C B105C
B106C B110C B111C

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR/WALL STOP	FS13/FS17 OR WS406/407CCV AS REQ	626	IVE
1	EA	FINGER GUARD	51A-180	A	ZER
1	EA	FINGER GUARD	951A	A	ZER

Hardware Group No. 06

For use on Door #(s):
B107

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	LV9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	LOCK GUARD	LG1	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A (OR PER SILL DETAIL)	A	ZER

Hardware Group No. 07

For use on Door #(s):
B100D B101D B103D B105D B110D

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL STORE LOCK	L9066L 06A XL11-897	626	SCH
2	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP RW/PA PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR/WALL STOP	FS13/FS17 OR WS406/407CCV AS REQ	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	AUTO DOOR BOTTOM	355AA	AA	ZER
1	EA	THRESHOLD	545A (OR PER SILL DETAIL)	A	ZER
1	EA	FINGER GUARD	51A-180	A	ZER
1	EA	FINGER GUARD	951A	A	ZER

Hardware Group No. 08

For use on Door #(s):
B109C

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP HW/PA PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR/WALL STOP	FS13/FS17 OR WS406/407CCV AS REQ	626	IVE
3	EA	SILENCER	SR64/65 AS REQ	GRY	IVE

Hardware Group No. 09

For use on Door #(s):
B109A B109B

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE W/SIM RETRACT W/ OUTSIDE INDICATOR	L9056L 06A L583-363 OS-OCC	626	SCH
1	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	SURFACE CLOSER	4040XP REG PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR/WALL STOP	FS13/FS17 OR WS406/407CCV AS REQ	626	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Group No. 10

For use on Door #(s):
G02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	GATE HINGES/PIVOTS	BY GATE MANUFACTURER		B/O
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-EO-WH	626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD-WH	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	MORTISE CYLINDER (MULLION)	MATCH CAMPUS STANDARD	626	BYO
2	EA	MORTISE CYLINDER (DOGGING)	MATCH CAMPUS STANDARD	626	BYO
1	EA	DOOR PULL	VR910 DT SNB	630	IVE
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
2	EA	SURFACE CLOSER	4040XP EDA PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 11

For use on Door #(s):
G01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	GATE HINGE/CLOSER	MAMMOTH180-ZILV	626	LOX
1	EA	CENTER POST/MULLION	BY GATE MANUFACTURER		B/O
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-EO-WH	626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD-WH	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
2	EA	MORTISE CYLINDER (DOGGING)	MATCH CAMPUS STANDARD	626	BYO
1	EA	DOOR PULL	VR910 DT SNB	630	IVE
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 12

For use on Door #(s):
G11

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	GATE HINGES/PIVOTS	BY GATE MANUFACTURER		B/O
1	EA	PADLOCK	KS43 OR MASTER AS REQ	606	SCH
1	EA	GATE LATCH	BY GATE MANUFACTURER		BYO

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 13

For use on Door #(s):
G13

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	GATE HINGES/PIVOTS	BY GATE MANUFACTURER		B/O
1	EA	PADLOCK	KS43 OR MASTER AS REQ	606	SCH
1	EA	GATE LATCH	BY GATE MANUFACTURER		BYO
	EA	NOTE	FIRE ACCESS GATE - KNOX BOX		

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 14

For use on Door #(s):
G06

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	GATE HINGE/CLOSER	MAMMOTH180-ZILV	626	LOX
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD-WH	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
2	EA	MORTISE CYLINDER (DOGGING)	MATCH CAMPUS STANDARD	626	BYO
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 15

For use on Door #(s):
G04 G05 G07 G08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	GATE HINGE/CLOSER	TIGER-ZILV	626	LOX
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-06-WH	626	VON
1	EA	RIM CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	MORTISE CYLINDER (DOGGING)	MATCH CAMPUS STANDARD	626	BYO
1	EA	FLOOR STOP	FS18S/L AS REQ	BLK	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 17

For use on Door #(s):
G03 G12

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	GATE HINGES/PIVOTS	BY GATE MANUFACTURER		B/O
1	EA	PADLOCK	KS43 OR MASTER AS REQ	606	SCH
1	EA	GATE LATCH	BY GATE MANUFACTURER		BYO
1	EA	FLOOR STOP	FS18S/L AS REQ	BLK	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 18

For use on Door #(s):
G09

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	GATE HINGES/PIVOTS	BY GATE MANUFACTURER		B/O
1	EA	CENTER POST/MULLION	BY GATE MANUFACTURER		B/O
2	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071L 06A IS-LOC	626	SCH
4	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
2	EA	SURFACE CLOSER	4040XP EDA PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S/L AS REQ	BLK	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 19

For use on Door #(s):
G10

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	GATE HINGES/PIVOTS	BY GATE MANUFACTURER		B/O
1	EA	CENTER POST/MULLION	BY GATE MANUFACTURER		B/O
2	EA	STOREROOM LOCK	L9080L LLL 06A L283-150	626	SCH
2	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
2	EA	DOOR PULL	VR900	630	IVE
2	EA	SURFACE CLOSER	4040XP EDA PROVIDE MOUNTING BRACKET, SPACER, PLATE AS REQUIRED	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS40 SERIES	626	IVE

BALANCE OF HARDWARE BY GATE FABRICATOR. CONFIRM HARDWARE WITH GATE FABRICATOR PRIOR TO ORDERING.

Hardware Group No. 29

For use on Door #(s):
A101

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 06A	626	SCH
1	EA	MORTISE CYLINDER	MATCH CAMPUS STANDARD	626	BYO
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR/WALL STOP	FS13/FS17 OR WS406/407CCV AS REQ	626	IVE
3	EA	SILENCER	SR64/65 AS REQ	GRY	IVE

End of Section

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this section.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300.

1.3 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Qualification Data: For installers.

C. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

D. Product Test Reports: For each types of glazing products specified.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain glazing products through one source from a single manufacturer for each glass type as practical.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

F. Safety Glazing Products:
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications:
      a. GANA's "Glazing Manual."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years.

C. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Fire-Rated Glass Manufacturers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Solarban 70 by Vitro (formerly PPG). (Basis of Design)
   2. SunGuard SNX 62/27 by Guardian.
   3. Oldcastle Building Envelope.
   4. Pilkington.
   5. Visteon.
   6. Or equal.

2.2 GLASS PRODUCTS

A. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
      a. Class II tempered safety glazing per CBC 2406.3 and Table 2406.1.

B. Clear Insulating-Glass Units: Insulated glass units. Low-e with glass to elastomer edge seal. Outer pane of clear glass, inner pane of clear glass. Place reflective coating on No.2 surface within the unit.
   1. Product: Solarban 70 (low -e coating) by Vitro (Basis of Design).
      a. Transmittance:
         1) Ultraviolet: 6%.
         2) Visible: 64%.
         3) Total Solar Energy: 25%.
      b. Reflectance:

1) Visible Light: 12%.
2) Total Solar Energy: 52%.

c. U-Value:
1) Winter Nighttime: 0.28.
2) Summer Daytime: 0.26.

d. Shading Coefficient (SC): 0.32.
e. Solar Heat Gain Coefficient (SHGC): 0.27.
f. Light to Solar Gain (LSG): 2.37.

2. Glazing Assembly:
a. Overall Unit Thickness: 1 inch.
b. Interspace Content: 1/2 inch of Air.
c. Outdoor Lite: 1/4 inch thick, tempered glass where required.
d. Indoor Lite: 1/4 inch thick, tempered glass where required.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Silicone complying with ASTM C 1115.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
   1. Silicone complying with ASTM C 1115.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   1. Silicone complying with ASTM C 1115.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
   1. Silicone complying with ASTM C 1115.

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
   1. Silicone complying with ASTM C 1115.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior suspension systems.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Deflection track: List location of use.

C. Certification of Materials: For steel framing materials.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Construction Standards: Construction not on Drawings or referenced shall be as detailed in Technical Library by SSMA Technical Services.

D. Deflection Limits: Maximum deflection of following at 5 psf.
   1. Gypsum board assemblies: L/240.
   2. Ceramic tile: L/360.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of non-load bearing steel framing that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Load-Bearing Steel Framing: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. California Expanded Metal Products Company (CEMCO).
   2. Clark Steel Framing Systems.
   3. Consolidated Systems, Inc.
   4. Dale/Incor.
   5. Dietrich Industries, Inc.
   6. Unimast, Inc.
   7. Western Metal Lath & Steel Framing Systems.
   8. Or equal.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 18 gage minimum.

B. Wire Hangers: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 inch (12 gage) diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (16 gage) and minimum 1/2-inch- wide flanges.
   1. Depth: As indicated on Drawings, but not less than 1-1/2 inch.

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Depth: As indicated on Drawings.
   2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).

E. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
   1. Leg Configuration: As indicated on Drawings.
   2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092400 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Exterior three-coat portland cement plasterwork (stucco) on metal lath system.
   2. Integral colored finish coat and field painted.

B. Related Sections:
   1. Division 6 Section “Sheathing” for exterior sheathing and weather resistive barrier.
   2. Division 7 Section "Building Insulation" for thermal insulations included in portland cement plaster assemblies.
   3. Division 7 Section “Flexible Sheet Flashing” for flashing windows, door, and other openings.
   4. Division 7 Section "Joint Sealants" for acoustical sealants and sealants installed with exterior portland cement plaster (stucco).
   5. Division 9 Section “Painting” for field painting of plaster.

1.2 SUBMITTALS

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

B. Shop Drawings:
   1. Showing details of construction for framing, reinforcement, and trims; including locations where each type material, mix, coating thickness, material sizes and thicknesses, and fastenings will be used.
   2. Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
   3. Include details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections to other work.
   4. Show locations and extent of weather-barrier (building paper and flashing sheet). Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
      a. Include details of interfaces with other materials that form part of weather barrier.
      b. Include details of mockups.

C. Coordination Drawings:
   1. Comprehensive, completely integrated set of plans, sections, elevations, and details, drawn to scale, of separate trades work, indicating interface support/connections, and relationships between materials, and products, on which the following items are shown and coordinated with each other, based on input from fabricators and installers of the items involved:
      a. Framing, including backing, blocking, strapping, and similar accessory/sub-framing materials.

b. Sheathing, including building paper.
c. Portland cement plaster, including trim and self-adhering flashing sheet.
d. Other materials and products that occur in, on, adjacent to, or contiguous with above work.

2. At a minimum, indicate the following
a. Locations/spacing of plaster trim moldings.
b. Locations/dimensions of self-adhering flashing sheet (underlying trim moldings).
c. Locations/spacings of connections/fastenings of:
1) Sheathing
2) Metal lath.
3) Plaster trim moldings
d. Sequence of installation of:
1) Building paper.
2) Flexible flashing.
3) Metal lath, and plaster trim moldings.

D. Samples for Initial Selection: For each type of factory-prepared finish coat indicated with texture and color.

E. Samples for Verification: For each type of factory-prepared finish coat indicated; 12 by 12 inches, and prepared on rigid backing with color selected.

1.3 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.5 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:
1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cement plaster system that fail in materials within specified warranty period. Failure includes, but is not limited to, blistering, peeling, flaking, delaminating, rusting, checking, crazing, fading beyond manufacturer's published limits, or chipping as a result of manufacturing defects.
   1. Warranty Period: 3 years.

B. Special Waterproof Warranty: Submit cement plaster system manufacturer's warranty certifying that work of this Section has been properly applied in strict accordance with system manufacturer's recommended procedures, instructions, and systems current applicable specifications; has been properly integrated into building construction in accordance with sound design and building construction practices; and will remain resistant to water penetration for specified warranty period.
   1. Warranty Period: 3 years.

C. Weather Resistive Barriers: 10 years.

D. Installer’s Warranty:
   1. Warranty Period: 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Plaster System: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. LaHabra Stucco. (District Standard)

B. Metal Lath: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Clark Western Metal Lath & Steel Framing Systems.
   2. Alabama Metal Industries Corporation (AMICO).
   3. California Expanded Metal Products Company (CEMCO).
   4. Dale/Incor.
   5. Unimast, Inc.
   6. Structa Wire Corp.
   7. Or equal.

A. Weather-Resistant Barrier: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. HydroTex by Fortifiber.(Basis of Design)
   2. GMC Roofing.
   3. Or equal.

B. Zinc-Coated (Galvanized) Steel Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Stockton Products. (Basis of Design)

2. Fry Reglet Corp.
3. Alabama Metal Industries Corporation (AMICO).
4. California Expanded Metal Products Company (CEMCO).
5. Dietrich Industries, Inc.
6. Brand X Metals.
7. Or equal.

C. Architectural EPS Shapes:
1. Foam Concepts, VEFO Inc.
2. Foam Design Center.
3. Or equal.

D. Aluminum Trim and Reveals: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. Fry Reglet Corp. (Basis of Design)
2. Flannery, Inc.
3. Gordon, Inc.
4. Pittcon Industries.
5. Brand X Metals, Inc.
6. Or equal.

2.2 MATERIALS

A. Stucco Materials:
1. LaHabra Fiber-47 Fastwall Scratch & Brown (3/4”):
a. LaHabra Fiber-47 Fastwall Scratch & Brown Concentrate: A factory blended portland cement, fibers, hydrated lime and proprietary ingredients, cement scratch and brown coat mixed in the field with sand, conforming to ASTM C926.

B. Leveling and Reinforcing Coat:
1. Stucco Level Coat: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
2. Parex USA 355 Standard Mesh: Weight 4.5 oz/yd2 (153 g/m2) reinforcing mesh.

C. LaHabra Finish:
1. Exterior Stucco Color Coat: Factory blend of portland cement, hydrated lime, aggregates and additives available in 16/20 and 20/30 aggregates.
2. Finish: Light sand finish.
3. Integral Color: Match field painted color.

D. Field painted finish: Comply with Division 9 Section “Painting”.

2.3 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G90, hot-dip galvanized zinc coating.
1. Diamond-Mesh Lath: Self-furring.
a. Weight: 3.4 lb/sq. yd.
b. Use: Vertical and horizontal solid support surfaces, such as unit masonry, concrete, or sheathing. Horizontal open framing up to 16 inches on center.

2. Diamond-Mesh Lath: Non-self-furring.
   a. Weight: 3.4 lb/sq. yd.
   b. Use: Attached with fastener when enforcing authority prohibit use of self-furring types.
3. 3/8-Inch Rib Lath (High Rib):
   a. Weight: 3.4 lb/sq. yd.
   b. Use: Horizontal open framing 24 inches on center.

B. Wire Lath: ES Report, ESR-2017, ASTM C847 with ASTM A641, Class 1 galvanized coating, by Structa Wire or equal.
1. Mega Lath: Self-furring.
   a. Weight: 1.95 lb/sq. yd.
   b. Use: Vertical and horizontal solid support surfaces.
2. V Truss Wall & Ceiling Lath : Rib Lath
   a. Weight: 1.95 lb/sq. yd.
   b. Use: Vertical and horizontal open framing.

2.4 WEATHER-RESISTANT BARRIER

A. Product: Hydrotex by Fortifiber or equal.
1. Description: Blended Super Jumbo Tex 60 Minute asphalt-saturated kraft paper with a drainable polymeric housewrap layer – packaged in a single roll.
2. ICC Evaluation Service Report 1027.
3. Tested Data:
   a. Moisture Vapor Transmission: ASTM E-96 Procedure A (Desiccant Method); 49.8 g/sm/day (7.6 perms).

2.5 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Zinc-Coated (Galvanized) Steel Accessories: Fabricated from hot-dip galvanized steel sheet, ASTM A 653 G90 zinc coating.
1. Foundation Weep Screed.
2. Cornerite: Fabricated.
3. External-Corner Reinforcement.
4. Cornerbeads.
   a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Small nose cornerbead with perforated flanges; use on curved corners.
   c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
   d. Bull nose cornerbead, radius 3/4 inch minimum, with expanded flanges; use at locations indicated on Drawings.
5. Casing Beads: Square-edged style; with expanded flanges.
6. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

7. Expansion Joints: Folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
   a. Internal Corners: Double-V, narrow reveal type ("No. 30").
8. Two-Piece Expansion Joints: Formed to produce slip-joint and square-edged reveal that is adjustable from 1/4-to-5/8-inch wide; with perforated flanges.
9. Stucco Reglet:
   a. Product: “ST” Stucco Reglet by Fry Reglet.
   b. Thickness: 24 gage.
10. Surface Mounted Reglet:
    a. Product: “SM” Surface Mount Reglet by Fry Reglet.
    b. Thickness: 24 gage.
11. Flashing System:
    a. Product: Springlok Flashing System by Fry Reglet.
    b. Thickness: 24 gage.
12. Termination Screed: J Mold.
    a. Product: J-B Bead by Stockton Products.
    b. Size: As indicated on Drawings.
13. Window /Door Drip: Door Drip Screed.
    a. Product: WTP Window Termination Point by Stockton Products.
    b. Size: As indicated on Drawings.
14. Drip Screed: Stucco Drip Soffit.
    a. Product: NFD #5 Drip by Stockton Products.
    b. Size: As indicated on Drawings.
15. Continuous Soffit Vents:
    a. Model VSC2120 Continuous Soffit Vent by Vulcan Technologies or equal.
    b. Aluminum honeycomb core, 5/8" nominal thickness with 1/4" cells.
    c. 1 to 2 mil cell walls.
    d. 1/4" stainless steel mesh Intumescent coating.
    e. Listing: California department of forestry & fire protection office of the state fire marshal fire engineering - building materials listing program.
    f. Passed ASTM E 2886 test.

C. Aluminum Trim and Reveals:
   1. Aluminum shall be extruded alloy 6063 T5, with clear anodized finish.
      a. Size: As indicated on Drawings.

D. Architectural EPS Shapes:
   1. Product: STYRO-loc system by Foam Concepts, VEFO Inc. or equal.
   2. Shapes: As indicated on Drawings.
   3. Components:
      a. STYRO-loc: 24 gauge metal insert placed a minimum of 2.5 inches from end of Architectural EPS Shape
      b. Metal Cap: Minimum 24 gauge galvanized sheet metal
      c. Metal Straps: Minimum 2 inches x 16 gauge galvanized sheet metal placed a maximum of 24 inches on center
      d. Adhesives and Base Coat: As recommended by foam manufacturer.
   4. Performance Requirements:
      a. Negative Uniform Load Testing: Ultimate failure shall not occur under 59 psf.
      b. Pull Out Capacity of Metal Insert: When loaded from a minimum of 12 inches from any end shall ultimately fail at no less than 227 pounds, and no less than 88 pounds when loaded at 1- inch from the end.

c. Vertical Load Testing: Ultimate failure on 12" shape shall not occur under 3200 lbs. at edges and 6330 lbs. at the interior location.
d. Structural Performance Test: Ultimate failure on 24" Shape shall not occur under 2963 lbs. at edges and 3181 at the interior location.
e. Fire Performance Test: Necessary to sustain conditions of acceptance as described in the ICC –ES Acceptance criteria for Foam Plastic (Section 4.7).
f. ESR Report: ESR-1823.

2.6 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063 and CBC Section 2507.
1. Nails, screws, and staples as specified in CBC.
2. Fastener for use with concrete/masonry for attaching lath and screeds/control joints, weeps and other shapes.
3. Wood Stud Applications: Galvanized steel furring nails and or screws, of type and length suitable for at least a 5/8 inch penetration of the wood stud system.

C. Sheathing: Comply with requirements of Division 6 Section "Sheathing".

D. Isolation Strip at Exterior Walls: Comply with requirements of Division 7 Section "Flexible Sheet Flashing" for flashing windows, door, and other openings.

E. Thermal Insulation: Comply with requirements of Division 7 Section "Building Insulation".

F. Acoustical Sealant for Exposed and Concealed Joints: Comply with requirements of Division 7 Section "Joint Sealants".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid-plaster bases that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Thermal Insulation: As specified in Division 7 Section “Building Insulation”.

B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH AND WEATHER-RESISTANT BARRIER INSTALLATION

A. Comply with CBC 2507.3 Lath attachment to horizontal wood supports (DSA-SS, DSA-SS/CC).
   1. Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.
      a. Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches above the bottom of the joist and the end of the wire secured together with three twists of wire.
      b. Secure lath to each support with 1/2 inch wide, 1-1/2 inch long No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches from edge of each sheet. Such staples may be placed over ribs of 3/8 inch rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.

B. General: Comply with requirements of Title 24.
   1. Use of self-furring lath is subject to satisfactory jobsite demonstration for each project of lath installation, with approval by Inspector of Record.

C. Expanded-Metal Lath: Install according to ASTM C 1063.
   1. Lath shall be attached to framing members at spacing of not more than 6 inches o.c., 2 inches maximum from longitudinal edges, in accordance with CBC.
   2. Lath shall not be continuous through control joints but shall be stopped and tied at each side per ASTM C1063, 7.10.1.4.

D. Weather-Resistant Barrier: Install 2 layers over sheathing.
   1. First layer: Fluid-applied waterproof air barrier membrane as specified in Division 6 Section “Sheathing”.
   2. Second layer: Weather resistive barrier specified in this section.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:

1. Install lath-type external-corner reinforcement at exterior locations.

C. Weep screed: Install at foundation plate line on all exterior stud walls per CBC 2512.1.2.
   1. Minimum 4 inches above earth.
   2. Minimum 2 inches above paved areas.

D. Control Joints: Install control joints in specific locations approved by Architect for visual effect as follows:
   1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
      a. Vertical Surfaces: 144 sq. ft.
      b. Horizontal and other Nonvertical Surfaces: 100 sq. ft.
   2. At distances between control joints of not greater than 18 feet o.c.
   3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
   4. Where control joints occur in surface of construction directly behind plaster.
   5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C 926.
   1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
   2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches at each jamb anchor.
   3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Three-Coat System: Total minimum thickness of 7/8 inch for lathing base per CBC Table 25A-F.
   1. Scratch Coat:
      a. Over Lathing Base: Apply scratch coat to a minimum thickness of 3/8 inch on vertical surface, and 1/4 inch on horizontal surface, using sufficient trowel pressure to key plaster into lath or to create bond to substrates as applicable. Prior to initial set, scratch horizontally to provide key for bond of brown coat.
   2. Brown Coat: Apply brown coat to a minimum thickness of 3/8 inch on vertical surface, and 1/4 inch on horizontal surface, using sufficient trowel pressure to insure tight contact with scratch coat.
      a. Rod surface to screeds creating true and even plane.
      b. Trowel to a sand float finish and uniform surface to receive finish coat.
      c. Tool brown coat to provide a V-joint at intersection of plaster with frames or other item of wood, or metal.
   3. Leveling and Reinforcing Coat:
      a. Allow Scratch & Brown Stucco Base to set and moist cure a minimum of 48 hours and allow to dry before applying the leveling and reinforcing coat.

b. Using a stainless steel trowel, apply the Stucco Level Coat over Stucco Base at a thickness of 1/16 – 3/32 in.
c. Fully embed the reinforcing mesh into the wet Stucco Level Coat including diagonal strips at corners of openings and trowel smooth. If Standard Mesh is used, seams are overlapped 2-½ in, and if the Intermediate Mesh is used, seams are butted and covered by strips of Detail mesh.

4. Cement Finish Coat:
   a. Apply Stucco Finish according to product datasheet and application instructions.
   b. Protect LaHabra Finish Coats from inclement weather until completely dry and cured.

C. Curing Time: Comply with CBC, or longer as needed to insure compliance with manufacturer's recommendations for quality stucco installation.
   1. Portland cement plaster:
      a. Minimum period moist curing:
         1) First Coat: 48 hours.
         2) Second Coat: 48 hours.
      b. Minimum interval between coats:
         1) First Coat: 48 hours.
         2) Second Coat: 7 days.

3.7 ASSEMBLY

A. Exterior Side from framing out:
   1. Sheathing.
   2. Weather-Resistive Barriers.
   3. Metal Lath.
   4. Portland cement plaster system.

3.8 CUTTING AND PATCHING

A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.

B. Related Sections include the following:
   1. Division 9 Section "Tiling" for tile backer board installed as substrates for ceramic tile.
   2. Division 9 Section “Painting” for primers and finishes applied to gypsum board surfaces.

1.2 SUBMITTALS

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

B. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Finishes: Level 4 and 5 of gypsum board finish indicated for use in exposed locations. 4 by 4 foot sample.
      a. Finishes: For each finish indicated and on same backing indicated for Work.

1.3 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each finish indicated.
      c. Each areas such as walls, ceilings, and soffits.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gypsum board that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Interior Gypsum Board: Subject to compliance with requirements, provide products by one of the following:
   1. Georgia Pacific. (District Standard)

B. Steel Trim Accessories: Subject to compliance with requirements, provide products by one of the following:
   1. USG Corporation.
   2. Amico.
   3. Or equal.

2.2 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X:
   1. Thickness: 5/8 inch for new work.
   2. Long Edges: Tapered.
   3. Products:
      a. Toughrock Fireguard X by Georgia Pacific.
      b. Type X by USG.
      c. Or equal.

C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Use: Toilet rooms and janitor's closets walls with painted finish.
      a. DensArmor Interior Guard by Georgia Pacific.
      b. USG Mold Tough Firecode Core Gypsum Panels by USG.
      c. XP Wallboard by National Gypsum.
      d. Or equal.

2.4 TRIM ACCESSORIES

A. Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim and Reveal: As specified in Division 9 Section "Portland Cement Plaster".

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Sealants shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Acoustical Sealant: Sheetrock Acoustical Sealant by USG or equal.
   1. Sealants shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

D. Thermal and Acoustical Insulation: As specified in Division 7 Section "Building Insulation."

E. Gypsum Board Adhesives:
   1. High performance latex-based construction adhesive designed for gypsum board applications.
   2. Adhesives shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.
   3. Products:
      a. Green Series SW-325 Shear & Drywall Adhesive by OSI.
      b. Drywall Adhesive GDWA by Grabberman.
      c. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Comply with GA 214 for Level definitions.
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for ceramic tile or acoustical tile.
3. Level 3: Where indicated on Drawings.

4. Level 4: At panel surfaces that will be exposed to view with flat paint finish.
   a. Primer and its application to surfaces are specified in other Division 9 Sections.
5. Level 5: At panel surfaces that will be exposed to view with non-flat paint finish.
   a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Porcelain tile.
   2. Cementitious backer units installed as part of tile installations.

1.2 SYSTEM DESCRIPTION

A. Accessibility Requirements for Tile Flooring:
   1. Tile Flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
   1. Propose locations of expansion, contraction, control, and isolation joints if not indicated on Drawings.

C. Installation Method: Show TCNA installation method number for each tiled area in tabulated form.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Qualification Data: For Installer.

G. Material Test Reports: For each tile-setting and -grouting product.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

D. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ceramic tile and accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ceramic and Porcelain Tile: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Daltile; Div. of Dal-Tile International Inc. (District Standard)

B. Setting, Grouting Materials: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Custom Building Products.
   2. LATICRETE International Inc.
   3. MAPEI Corporation.
   4. Sienna.
   5. Tec by H.B. Fuller.
   6. Or equal.

C. Sheet Waterproofing for Tile Installation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Noble Company (The); Nobleseal TS.
   2. Schluter; KERDI XL.
   3. Or equal.

D. Cementitious Backer Board: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. USG Corporation; DUROCK Cement Board.
   2. National Gypsum Company; PermaBase.
   3. C-Cure; C-Cure Board 990.
   4. Custom Building Products; Wonderboard.
   5. Or equal.

E. Metal Edge Strips and Transitions: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Schluter Systems (Basis of Design).
   2. Blanke.
   3. Or equal.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. Products: As indicated on Drawings.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
   1. Vendor: White Georgia Marble Co.
   2. Description: Match Architect's sample.

2.5 SHEET WATERPROOFING FOR TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

B. Thin (1/32 inch) bonded, load bearing sheet membrane for waterproofing. Alloy made from Chlorinated Polyethylene (CPE) with nonwoven fabric laminated to both sides.
   1. System Performance: 1-14 “Extra Heavy Service” cycles per ASTM C627.
   2. Hardness: 82 shore A per ASTM D2240.
   3. Tensile Strength: 1600 psi per ASTM D412 Die C.
   4. Elongation: 44% per ASTM D412 Die C.
   5. Tear Strength: 400 psi per ASTM D624 Die C.
   6. Shear Strength: Pass per ANSI A118.10-1993.
   7. Shear Strength - Water Immersion: Pass per ANSI A118.10-1993.
   8. Fungus & microorganism Resistance: Pass per ANSI A118.10-1993.
   9. Seam Strength: Pass per ANSI A118.10-1993.
   10. Waterproofness: Pass per ANSI A118.10-1993.

A. Product: Kerdi System by Schluter or equal.
   1. Description: Polyethylene Membrane: 0.008 inch thick, orange with polypropylene fleece laminated on both sides.
   2. Meets or exceeds requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10.
   3. Evaluated by ICC-ES. See Report No. ESR-2467.
   4. Accessories: Schluter-Kerdi-Drain.
      a. Plastic floor drain 11-25/32 inch diameter, trapezoid-perforated, integrated bonding flange or stainless steel as required by code.
      b. Polypropylene Fleece: Thermally laminated to surface and hubbed connection to 2 inch drainpipe.

c. Grate Assembly: Includes 4 x 4 inch square grate, height adjustment collar, and lateral adjustment ring with trapezoid perforations.

2.6 SETTING AND GROUTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
2. Products:
a. MAPEI: Ultraflex 2, Walls: MAPEI Ultralite.
b. 254 Platinum by Laticrete.
c. Custom Building Products: MegaFlex.
d. Schluter: Allset.
e. Or equal.

B. Chemical-Resistant, Water-Cleanable, Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F and 212 deg F, respectively, and certified by manufacturer for intended use.
2. Products:
a. MAPEI: Kerapoxy IEG.
b. SpectraLock Pro by Laticrete.
c. Custom Building Products: 100% Solids Epoxy Grout.
d. Or equal.

2.7 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.8 TILE BACKER UNITS

A. Cementitious Back Units:
1. Aggregated portland cement board with coated glass-mesh reinforcement scrim.
2. Comply with ANSI A118.9.
3. Pass ASTM E136 for non-combustibility.
4. Thickness: As indicated on Drawings.
5. Lengths: Maximum lengths available to minimize end-to-end butt joints.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
      a. Sub-floor and Vertical Surfaces: 1/4 inch in 10 feet.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
   3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
   1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.

G. Grout tile to comply with requirements of the following tile installation standards:
   1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 WATERPROOFING INSTALLATION

A. Do not install tile over waterproofing until waterproofing has been tested to determine that it is watertight.

3.6 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: 1/16 inch unless specified otherwise.

3.7 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

3.8 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.9 WALL TILE INSTALLATION, TCNA ASSEMBLY

A. Tile Installation: Interior wall installation over cementitious backer units; thin-set mortar; TCNA W244C with epoxy grout and ANSI A108.5.
   1. Mortar: Latex-portland cement mortar.
   2. Grout: Chemical-resistant, water-cleanable, tile-grouting epoxy.

3.10 FLOOR TILE INSTALLATION, TCNA ASSEMBLY

A. Tile Installation: Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCNA F122 and ANSI A108.5.

1. Mortar: Latex-portland cement mortar.
2. Grout: Chemical-resistant, water-cleanable, tile-grouting epoxy.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Acoustical panels and suspension systems for ceilings.
   2. Acoustical disc reflectors.

1.2 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

F. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 450 or less.
      b. Flame-Spread Rating: Class 1 (0-25).

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical panel ceilings that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 1 year.

B. Installer's Warranty: 1 year.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical Panels: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. USG Interiors, Inc. (District Standard)

B. Suspension Systems: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. USG/Donn Interiors, Inc. (District Standard)

C. Acoustical disc reflectors:
   1. Quiet Technology Systems (QST). (Basis of Design)
   2. Or equal.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

2.3 ACOUSTICAL PANELS

A. Products: As indicated on Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

H. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

I. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEMS

A. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; heavy-duty.
   1. Product: Heavy Duty, ESR-1222.
      a. Profile: Tee; 15/16 inch wide face.
      b. Construction: Double web.
      c. Structural Classification: ASTM C 635 Heavy-Duty.
      d. Finish: Factory painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2.7 ACOUSTICAL DISC REFLECTORS

A. Product: Acc-U-Sound Disc Reflector 15’ by QST or equal.
   1. Composition: Rigid molded fiberglass with Smooth Gel Coat finish.
   2. Fin Bracing: Offset cross bracing for reduced surface deflection. Fins are solid core encased in fiberglass resin for integral construction.
   3. Mounting: Reinforced hole is provided at each fin near disc edge for mounting.
   4. Fire tested according to ASTM-84 Tunnel Test and have a flame spread rating of less than 25 (class “A”)
   5. Weight: Approx. weight 2.5psf.
   6. Finishes: As selected by Architect from 40 Standard colors.

2.8 ACOUSTICAL SEALANT

A. Comply with requirement of Division 7 “Joint Sealants”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Install suspension system and panels in accordance with manufacturer’s written instructions.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and

touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wall base.
   2. Molding accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Resilient Flooring:
   1. Resilient Flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

A. Pre-Molded Corners: Pre-molded inside and outside rubber base corners shall be from same production run as straight base. These are commonly from different production run and as result are different color shades. This color difference often negates premium appearance of pre-molded products.

B. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of resilient wall base and accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Type TP Resilient Wall Base: Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
   1. Burke Mercer Flooring Products. (Basis of Design)
   2. Johnsonite.
   3. Allstate Rubber.
   4. Armstrong.
   5. Or equal.

2.2 RESILIENT WALL BASE

A. Product: As indicated on Drawings.

2.3 RESILIENT MOLDING ACCESSORY

A. Types:
   1. Reducer strip for resilient floor covering
   2. Joiner for tile and carpet.

B. Material: Rubber.

C. Profile and Dimensions: As indicated.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
   a. Rubber Floor Adhesives: 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates:
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

G. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.
4. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 096513

SECTION 096813 – TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes modular, carpet tile and walkoff mat.

B. Related Sections include the following:
   1. Division 9 Section “Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Carpets:
   1. Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. It shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be 1/2” maximum. CBC Section 11B-302.2.
   2. Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length. Carpet edges shall comply with CBC Section 11B-303.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
   1. Include concrete moisture and alkalinity limits.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Existing flooring materials to be removed.
   3. Existing flooring materials to remain.
   4. Carpet tile type, color, and dye lot.
   5. Type of subfloor.
   6. Type of installation.
   7. Pattern of installation.
   8. Pattern type, location, and direction.
   9. Pile direction.
   10. Type, color, and location of insets and borders.
   11. Type, color, and location of edge, transition, and other accessory strips.
   12. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
1. Review delivery, storage, and handling procedures.
2. Review ambient conditions and ventilation procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, and delamination.
   3. Warranty Period: Lifetime.

B. Installer's Warranty: 1 year.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carpet Tile and Walkoff Mat: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Tarkett; formerly Tandus Centiva. (District Standards

2.2 CARPET TILE AND WALKOFF MAT

A. Products: As indicated on Drawings.
   1. Fire test per ASTM E 648: Class A.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and as recommended/ required by the manufacturer for warrantee acceptance or provided by carpet tile manufacturer for the type of carpet being installed.
   1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
      a. Total VOCs: 50g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Substrates:
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 098319 - ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Acoustical wall panels and installation components.
   2. Sound diffusing wall panels.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical wall panel required.

B. Samples: Minimum 3 inch x 3 inch samples of specified acoustical wall substrate; minimum 4 inch long samples of attachment method including trim and decorative accents.

C. Shop Drawings: Submit shop drawings showing how panels are to be laid out on the walls, details of trim members and width of panels. Width of panels and location of vertical seams are critical.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and installation components by a single manufacturer.

B. Coordination of Work: Coordinate acoustical wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical wall panels to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical wall panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical wall panels carefully to avoid chipping edges or damaged units in any way.

1.5 WARRANTY

A. Acoustical Wall Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to manufacturer's defects.

B. Warranty Period:
   1. Acoustical wall panels: 1 year.
   2. Fabric: 1 year.

C. Installer's Warranty: 1 year.

1.6 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Acoustical Wall Panels: Furnish quantity of full-size units equal to 5.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical and Sound Diffusing Wall Panels:
   1. Kinetics Noise Control, Inc. (Basis of Design)
   2. Armstrong World Industries.
   3. Decoustics.
   4. Tectum
   5. Or equal.

B. Fabric:
   1. Gulford of Maine.
   2. Carnegie.
   3. Xorel.
   4. Or equal.

2.2 ACOUSTICAL WALL PANELS

A. Product: High Impact HardSide by Kinetics
   1. Description: A two-part composite panel, the High Impact HardSide panel has a 6-7 PCF density core with a 1/8" thick, high density impact resistant skin laminated on the core face. The higher density face gives the High Impact HardSide panel greater abuse resistance, tackability, and higher sound absorption.
   2. Composition:
      a. 6-7 PCF density fiberglass core.
      b. 1/8" high impact "skin".

c. Chemically hardened edges.
d. Wrapped in fabric from Guilford of Maine, or factory-approved customer-selected material.

3. Tested Data:
   a. Fire: Class A per ASTM E84.
   b. Noise Reduction Coefficient (NRC): ASTM C 423.
      1) 1-1/8 inch thick: NRC of 1.00.
      2) 2-1/8 inch thick: NRC of 1.05.
      3) 3-1/8 inch thick: NRC of 1.05.
      4) 4-1/8 inch thick: NRC of 1.15.

B. Acoustical Wall Panel Accessories:
   1. Impaling clips.
   2. Z-clips.

2.3 SOUND-DIFFUSING WALL PANELS.

A. Product: ScatterBox Wood Diffuser Panels by Kinetics or equal.
   1. Panels shall be constructed from solid hardwood, 3/8-inch thick perimeter frame and 1/4 inch thick interior ribs.
   2. The panel shall have 64 wells of 4 different depths arranged in a quasi – random pattern to optimize diffusion and minimize visual pattering.
   3. The well array design and varying depths shall create sound diffusion in two dimensions, both vertical and horizontal (wall mounted).
   4. Panels are wall mounted per manufacturer's guidelines. Panel dimensions also allow for installation in a standard lay-in ceiling grid.
   5. Components:
      a. 23-5/8" x 23-5/8" x 3" panels.
      b. Quasi-random reflective surface array distributes sound evenly within the listening space.
      c. Lay-in ceiling design or wall mounted.
      d. Optimize desirable reflections in music performance, rehearsal and recording spaces.
      e. Solid wood: Hemlock (standard).
      f. Fire Rated MDF Core.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

A. Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

A. Install wall panels by attaching the panels per the manufacturer's instructions and in accordance with the authorities having jurisdiction.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

END OF SECTION 098319

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Surface Preparation.
   2. Field application of paints, stains, varnishes, and other coatings.

1.2 SUBMITTALS

A. Product data - Submit product data sheets for each product.

B. Samples:
   1. Submit two painted samples, illustrating selected colors and textures for each color and systems selected with specified coats cascaded.
   2. Submit on suitable backing, 8x10 inch size.

1.3 QUALITY ASSURANCE

A. Painting Contractor is required to attend a pre-construction meeting with the District prior to commencement of all projects.

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

C. Environment Requirements:
   1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
   2. Do not paint when there is a threat of rain within 24 hours or when surface or air temperatures are at or below 40 degrees.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace paint that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

1.7 EXTRA STOCK

A. Minimum 1 gallon each product in original or new 1 gallon cans.
   1. Color spot each lid.
   2. Identify with formula, location, product and date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paints: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Vista Paint. (District Standard)

2.2 PAINTS AND COATINGS

A. Ready mixed, except field-catalyzed coatings.

B. Prepare pigments:
   1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application. Do not proceed unless substrate is suitable.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent
3. Interior Wood: 15 percent, measured in accordance with ASTMD4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTMD4442.

3.2 PREPARATION OF SURFACE

A. General:
1. Clean all exterior walls and surfaces of loose and scaly paint, dirt, dust, chalk, and other foreign matter by water-blasting using care not to damage substrate followed by hand scraping, sanding or wire brushing after surfaces are dry. Mildew must be treated with household bleach solution and rinsed thoroughly.
2. Patch, caulk, set protruding nails and repair all surfaces and cracks where necessary with suitable patching materials and smooth off to match adjacent surfaces.
3. Sand Glossy surfaces to dull surface and remove residue.
4. Remove mildew from affected surfaces with a solution of Tri-Sodium Phosphate and bleach. Rinse with clean water and allow to dry completely.
5. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to priming and painting. Patched and bare areas shall be spot primed with the same primer as specified for new work.
6. Rusty metal: Scrape, sand or wire wheel, feathering edges to sound coating. Dust surfaces. Topcoat.
7. Remove soil and body oils completely from surfaces, including handrails, door edges and posts. Treat with Liquid Sandpaper or Dull-N-Bond.
8. Remove hardware, accessories, plates, fixtures and similar items not to be finished. Reinstall at completion.
9. Paint edges of sink cut-outs.

B. CMU Surfaces:
1. Remove dirt, loose mortar, scale, powder and other foreign matter from concrete block surfaces which are to be painted.
2. Unpainted CMU surfaces shall be cleaned with TSP. Rinse thoroughly. Surface shall be tested for adhesion. Prime as listed in materials section; allow to cure, then perform adhesion test with duct tape.

C. Galvanized Surfaces: Remove all oils and contamination from galvanized surfaces scheduled to be painted by washing with a compliant solvent wash.

D. Ferrous Metal: Remove grease, rust, scale, dirt and dust from ferrous metal surfaces. Primer coat shall be applied not less than 30 minutes, nor more than 3 hours after preparation of surface.

E. Primed Metal: Sand and scrape shop primed metal to remove loose primer and rust. Touch-up bare, abraded and damaged areas with metal primer. Feather edges to make touch-up patches inconspicuous.

F. Wood Surfaces:
1. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot prime knots, pitch streaks and sappy sections with a stain blocking primer where surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs after patching material has fully cured.

2. Wood surfaces with peeling areas are to have edges of broken paint film sanded to a feather edge.
3. Back prime wood trim. Paint tops, bottoms, edges and cut-outs of doors.

G. Plaster Surfaces:
1. Plaster surfaces shall be dry and free from efflorescence, encrustations and foreign matter. Fill cracks, holes and imperfections, smoothing repairs to match adjacent texture. Allow repairs to fully cure before priming.
2. Prime plaster surfaces with specified primer. Caulk all cracks.

H. Gypsum Board: Gypsum board shall be dusted clean and free from encrustations and other foreign matter.

I. Preparation of other surfaces shall be performed following specific recommendations of the coating manufacturer.

3.3 PREVISOUSLY COATED SURFACES

A. Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before repainting. Thorough washing with an abrasive cleanser will clean and dull in one operation, or, wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required per ASTM D4259.

3.4 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved

E. Sand wood surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust particles just prior to applying next coat.

G. Stipple all edges and corners to conceal brush marks.

H. Paint entire trim element with like color. Painting of faces only is unacceptable. Trim surfaces must be wrapped with the trim color and not "faced off" or "Hollywooded".

I. Doors: Paint entire door unless otherwise noted, including door top and bottom edge surfaces.

J. Tinting: Tint each primer a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint primer to match the color of the finish coat, but provide sufficient differences in shade of primer to distinguish each separate coat.

3.5 PROTECTION

A. Protect work of other trades and items not intended to receive paint. Install "wet paint" signs to protect newly painted surfaces.

3.6 CLEANING

A. Protection - Carefully protect areas where work is in progress from damage.
   1. Provide and spread clean drop cloths when and where required to provide the necessary protection.
   2. Immediately clean-up all accidental spatter, spillage, misplaced paint and restore the affected surface to its original condition.

B. Clean-up:
   1. Clean up debris daily per OSHA requirements.
   2. At completion of work, remove all materials, supplies, debris and rubbish and leave each area in a clean, acceptable condition.
   3. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.7 SURFACES TO BE FINISHED

A. Paint all new work and areas affected by new work, unless noted otherwise.

B. Do not paint or finish the following items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint shop primed items occurring in finished areas.
   3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint.
   4. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

3.8 PAINT SYSTEMS – EXTERIOR

A. CONCRETE – PLASTER – STUCCO
   1. FLAT: Premium Quality
      a. First Coat 4600 Uniprime II (100% Acrylic Primer)
      b. Second Coat 3000 Acribond (100% Acrylic Solid Stain)
      c. Third Coat 3000 Acribond (100% Acrylic Solid Stain)
   2. FLAT ELASTOMERIC: Premium Plus Quality
      a. First Coat 4600 Uniprime II (100% Acrylic Primer)
      b. Second Coat 500 Solotex Multi-Mil Acrylic Elastomeric
      c. Third Coat 500 Solotex Multi-Mil Acrylic Elastomeric
   3. EGGSHELL ENAMEL: Premium Plus Quality
      a. First Coat 4600 Uniprime II (100% Acrylic Primer)
      b. Second Coat 8300 Carefree Eggshell (100% Acrylic)
      c. Third Coat: 8300 Carefree Eggshell (100% Acrylic)
   4. SEMI-GLOSS ENAMEL: Premium Plus Quality
      a. First Coat 4600 Uniprime II (100% Acrylic Primer)
      b. Second Coat 8400 Carefree Semi-Gloss (100% Acrylic)
      c. Third Coat 8400 Carefree Semi-Gloss (100% Acrylic)
   5. GLOSS ENAMEL: Premium Plus Quality
      a. First Coat 4600 Uniprime II (100% Acrylic Primer)
      b. Second Coat 8500 Carefree Gloss (100% Acrylic)
      c. Third Coat 8500 Carefree Gloss (100% Acrylic)

B. METAL: FERROUS (Unprimed)
   1. FLAT: Water-based Acrylic: Premium Plus Quality
      a. First Coat 9600 Protec Metal Prime
      b. Second Coat 2000 Duratone (100% Acrylic)
      c. Third Coat 2000 Duratone (100% Acrylic)
   2. EGGSHELL ENAMEL : Water-based Acrylic : Premium Plus Quality
      a. First Coat 9600 Protec Metal Prime
      b. Second Coat 8300 Carefree Eggshell (100% Acrylic)
      c. Third Coat 8300 Carefree Eggshell (100% Acrylic)
   3. EGGSHELL ENAMEL: Water-based Alkyd Emulsion: Premium Plus Quality
      a. First Coat 9600 Protec Metal Primer
      b. Second Coat 9700 Protec Alkyd Emulsion Satin
      c. Third Coat 9700 Protec Alkyd Emulsion Satin
   4. SEMI-GLOSS ENAMEL: Water-based Acrylic: Premium Plus Quality
      a. First Coat 9600 Protec Metal Prime
      b. Second Coat 8400 Carefree Semi-Gloss (100% Acrylic)
      c. Third Coat 8400 Carefree Semi-Gloss (100% Acrylic)
   5. SEMI-GLOSS ENAMEL: Water-based Alkyd Emulsion: Premium Plus Quality
      a. First Coat 9600 Protec Metal Primer
      b. Second Coat 9800 Protec Alkyd Emulsion Semi-Gloss
      c. Third Coat 9800 Protec Alkyd Emulsion Semi-Gloss
   6. GLOSS ENAMEL : Water-based Acrylic: Premium Plus Quality
      a. First Coat 9600 Protec Metal Prime
      b. Second Coat 8500 Carefree Gloss (100% Acrylic)
      c. Third Coat 8500 Carefree Gloss (100% Acrylic)
   7. GLOSS ENAMEL : Water-based Alkyd Emulsion: Premium Plus Quality
      a. First Coat 9600 Protec Metal Primer
      b. Second Coat 9900 Protec Alkyd Emulsion Gloss
      c. Third Coat 9900 Protec Alkyd Emulsion Gloss

C. METAL: NON-FERROUS, GALVANIZED (Unprimed)
1. FLAT: Premium Plus Quality
   a. Pre-Treatment: Krud KutterMetal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 2000 Duratone (100% Acrylic)
   d. Third Coat 2000 Duratone (100% Acrylic)
2. EGGSHELL ENAMEL: Water-based Acrylic: Premium Plus Quality
   a. Pre-Treatment: Krud Kutter Metal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 8300 Carefree Eggshell (100% Acrylic)
   d. Third Coat 8300 Carefree Eggshell (100% Acrylic)
3. EGGSHELL ENAMEL: Water-based Alykd Emulsion: Premium Plus Quality
   a. Pre-Treatment: Krud Kutter Metal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 9700 Protec Alykd Emulsion Satin
   d. Third Coat 9700 Protec Alykd Emulsion Satin
4. SEMI-GLOSS ENAMEL: Water-based Acrylic: Premium Plus Quality
   a. Pre-Treatment: Krud Kutter Metal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 8400 Carefree Semi-Gloss (100% Acrylic)
   d. Third Coat 8400 Carefree (100% Acrylic)
5. SEMI-GLOSS ENAMEL: Water-based Alykd Emulsion: Premium Plus Quality
   a. Pre-Treatment: Krud Kutter Metal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 9800 Protec Alykd Emulsion Semi-Goss
   d. Third Coat 9800 Protec Alykd Emulsion Semi-Gloss
6. GLOSS ENAMEL: Water-based Acrylic: Premium Plus Quality
   a. Pre-Treatment: Krud Kutter Metal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 8500 Carefree Gloss (100% Acrylic)
   d. Third Coat 8500 Carefree (100% Acrylic)
7. GLOSS ENAMEL: Water-based Alykd Emulsion: Premium Plus Quality
   a. Pre-Treatment: Krud Kutter Metal Clean & Etch
   b. First Coat 4800 Metal Pro Primer
   c. Second Coat 9900 Protec Alykd Emulsion Gloss
   d. Third Coat 9900 Protec Alykd Emulsion Gloss

D. WOOD
1. FLAT: Premium Plus Quality
   a. First Coat 4200 Terminator II (100% Acrylic Primer)
   b. Second Coat 2000 Duratone (100% Acrylic)
   c. Third Coat 2000 Duratone (100% Acrylic)
2. EGGSHELL ENAMEL: Premium Plus Quality
   a. First Coat 4200 Terminator II (100% Acrylic Primer)
   b. Second Coat 8300 Carefree Eggshell (100% Acrylic)
   c. Third Coat: 8300 Carefree Eggshell (100% Acrylic)
3. SEMI-GLOSS ENAMEL: Premium Plus Quality
   a. First Coat 4200 Terminator II (100% Acrylic Primer)
   b. Second Coat 8400 Carefree Semi-Gloss (100% Acrylic)
   c. Third Coat 8400 Carefree Semi-Gloss (100% Acrylic)
4. GLOSS ENAMEL: Premium Plus Quality

a. First Coat 4200 Terminator II (100% Acrylic Primer)
b. Second Coat 8500 Carefree Gloss (100% Acrylic)
c. Third Coat 8500 Carefree Gloss (100% Acrylic)

E. CONCRETE – ASPHALT – LINE STRIPING
1. FLAT:
a. First Coat 6700 ON-LINE Flat Traffic Marking Paint
b. Second Coat 6700 ON-LINE Flat Traffic Marking Paint
2. SEMI-GLOSS ENAMEL:
a. First Coat 6800 ON-LINE Semi-Gloss Traffic Marking Paint
b. Second Coat 6800 ON-LINE Semi-Gloss Traffic Marking Paint
3. FLAT W/ REFLECTIVE BEADS: QUICK-DRY
a. First Coat 6900 ON-LINE Flat QD Traffic Marking Paint
b. Second Coat 6900 ON-LINE Flat QD Traffic Marking Paint

3.9 PAINT SYSTEMS – INTERIOR (Premium Low or Zero VOC)

A. Gypsum Board Surfaces (Drywall) Acrylic Flat Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 7100 Acriglo Flat Finish
3. Third Coat: 7100 Acriglo Flat Finish

B. Gypsum Board Surfaces (Drywall) 100% Acrylic Low-Sheen Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 1750 Acriglo Velva Sheen Finish
3. Third Coat: 1750 Acriglo Velva Sheen Finish

C. Gypsum Board Surfaces (Drywall) 100% Acrylic Eggshell Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 7500 Acriglo Eggshell Finish
3. Third Coat: 7500 Acriglo Eggshell Finish

D. Gypsum Board Surfaces (Drywall) 100% Acrylic Semi-Gloss Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 7000 Acriglo Semi-Gloss Finish
3. Third Coat: 7000 Acriglo Semi-Gloss Finish

E. Concrete, Plaster, Masonry – Acrylic Flat Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 7100 Acriglo Flat Finish
3. Third Coat: 7100 Acriglo Flat Finish

F. Concrete, Plaster, Masonry – 100% Acrylic Low Sheen Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 1750 Acriglo Velva Sheen Finish
3. Third Coat: 1750 Acriglo Velva Sheen Finish

G. Concrete, Plaster, Masonry – 100% Acrylic Eggshell Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 7500 Acriglo Eggshell Finish

3. Third Coat: 7500 Acriglo Eggshell Finish

H. Concrete, Plaster, Masonry – 100% Acrylic Semi-Gloss Finish
1. First Coat: 7001 Acriglo Primer
2. Second Coat: 7000 Acriglo Semi-Gloss Finish
3. Third Coat: 7000 Acriglo Semi-Gloss Finish

I. Concrete Masonry Unit (CMU) Acrylic Flat Finish
1. First Coat: 040 Acrylic Block Filler
2. Second Coat: 7100 Acriglo Flat Finish
3. Third Coat: 7100 Acriglo Flat Finish

J. Concrete Masonry Unit (CMU) 100% Acrylic Low Sheen Finish
1. First Coat: 040 Acrylic Block Filler
2. Second Coat: 1750 Acriglo Velva Sheen Finish
3. Third Coat: 1750 Acriglo Velva Sheen Finish

K. Concrete Masonry Unit (CMU) 100% Acrylic Eggshell Finish
1. First Coat: 040 Acrylic Block Filler
2. Second Coat: 7500 Acriglo Eggshell Finish
3. Third Coat: 7500 Acriglo Eggshell Finish

L. Concrete Masonry Unit (CMU) 100% Acrylic Semi-Gloss Finish
1. First Coat: 040 Acrylic Block Filler
2. Second Coat: 7000 Acriglo Semi-Gloss Finish
3. Third Coat: 7000 Acriglo Semi-Gloss Finish

M. Wood – 100% Acrylic Low-Sheen Finish
1. First Coat: 4200 Terminator II Primer
2. Second Coat: 1750 Acriglo Velva Sheen Finish
3. Third Coat: 1750 Acriglo Velva Sheen Finish

N. Wood – 100% Acrylic Eggshell Finish
1. First Coat: 4200 Terminator II Primer
2. Second Coat: 7500 Acriglo Eggshell Finish
3. Third Coat: 7500 Acriglo Eggshell Finish

O. Wood – 100% Acrylic Semi-Gloss Finish
1. First Coat: 4200 Terminator II Primer
2. Second Coat: 7000 Acriglo Semi-Gloss Finish
3. Third Coat: 7000 Acriglo Semi-Gloss Finish

P. Metal: Ferrous – Water Base Alkyd Semi-Gloss Finish
1. First Coat: 9600 Protec Alkyd Emulsion Metal Primer
2. Second Coat: 9800 Protec Semi-Gloss Finish
3. Third Coat: 9800 Protec Semi-Gloss Finish

Q. Metal: Non-Ferrous (Galvanized) Water Base Alkyd Semi-Gloss Finish
1. Pretreatment: Krud Kutter Metal Clean and Etch
2. First Coat: 4800 Metal Pro Acrylic Metal Primer
3. Second Coat: 9800 Protec Semi-Gloss Finish

4. Third Coat: 9800 Protec Semi-Gloss Finish

3.10 COLORS

A. To be selected by Architect from manufacturer's full range of colors.

END OF SECTION 099100

SECTION 101100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Tackboards.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Show location of special-purpose graphics for visual display surfaces.
   3. Include sections of typical trim members.

C. Schedule: List product, size, and type by room numbers.

D. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
   1. Actual sections of face sheet and tack assembly.
   2. Samples of accessories involving color selection.

E. Samples for Verification: For each type of visual display surface indicated and as follows:
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch- long sections of each trim profile.
   3. Accessories: Full-size Sample of each type of accessory.

F. Maintenance Data: For visual display surfaces to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
   2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.6 WARRANTY

A. Special Warranty for Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces become slick or shiny.
      c. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tackboard: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Koroseal. (District Standard)

2.2 TACK BOARD

A. Product: tac•wall by Koroseal or equal.
   1. Description: Resilient, tackable, linoleum surface material. Uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing.
   2. Width: 48 inch.
   3. Gauge: 1/4 inch.
   4. Roll: Approximately ± 95 lineal foot rolls.
   5. Flexible enough to bend around a 2-3/4 inch radius.
   6. Dimensionally stable due to burlap backing.
   7. Meets California Indoor Air Quality Specifications 01350.
   8. Color: Color shall extend through thickness of material.
      a. As selected by Architect from manufacturer’s full range.
   9. Size: As indicated on Drawings.

B. Aluminum Trim: 1/4 inch clear satin, anodized aluminum.
   1. 5/16 inch face J Trim.
   2. 1/2 inch face H Trim.
   3. 5/16 inch face Outside Trim.
   4. 5/16 inch face Inside Trim

C. Accessories:
   1. Adhesive: Solvent-free, SBR type linoleum adhesive (L-910) or polyvinyl acetate dispersion type (contact adhesive) when used in a press.
   2. Caulk: Color matched to tackable wall.

2.3 ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.
   1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous.
   1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:
   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
   2. End Stops: Located at each end of map rail.
   3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof.
   4. Flag Holder: One for each room.

2.4 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
   3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.5 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls and partitions for proper backing for visual display surfaces.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Units shall be braced in place to allow curing of adhesive. There shall be no gaps or voids in adhesion and units shall not give when pushed.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Visual Display Boards shall be attached to the wall by spreading adhesive over the entire back of the panel with 1/4 inch notched trowel. Panels shall be braced to provide thorough adhesion to the substrate, and shall exhibit no “sponginess” when pressed.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101100

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Panel signs (room signs).
   2. Parking signs.
   3. Traffic signs.
   4. Exterior building signs.
   5. Signage accessories.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Raised characters shall comply with CBC Section 11B-703.2.:
      a. Depth: It shall be 1/32 inch (0.8 mm) minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
      b. Height: It shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter “I”. CBC Section 11B-703.2.5.
      c. Finish and contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1
      d. Proportions: It shall be selected from fonts where the width of the uppercase letter “O” is 60 % minimum and 110 % maximum of the height of the uppercase letter “I”. Stroke thickness of the uppercase letter “I” shall be 15 % maximum of the height of the character. CBC Sections 11B-703.2.4.
      e. Character Spacing: Spacing between individual tactile characters shall comply with CBC Section 11B-703.2.7.
      f. Line Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.2.8.
      g. Format: Text shall be in a horizontal format per CBC Section 11B-703.2.9.
      h. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed and rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
      i. Mounting height: A tactile sign shall be located 48” minimum to the baseline of the lowest Braille cells and 60” maximum to the baseline of the highest line of raised characters above the finish floor or ground surface.
      j. Mounting location: A tactile sign shall be located on the approach side, as one enters or exits rooms or space, and be reached within the required clear floor space per CBC Section and Figure 11B -703.4.2 as follows:
         1) a clear floor space of 18’ x 18” minimum, centered on the tactile characters, shall be provided beyond the arc of any door swings between the closed position and 45 degree open position.
         2) on the wall at the latch side of a single door.
         3) on the inactive leaf of a double door with one active leaf.

4) on the wall at the right side of a double door with two active leafs.
5) on the nearest adjacent wall where there is no wall space at the latch side of a single door or no space at the right side of a double door with two active leafs.

2. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground. Visual character stroke thickness of the uppercase letter "I" shall be 10% minimum and 20% maximum of the height of the character per CBC Section 11B-703.5.7.
   a. Line Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.5.9.
   b. Character Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.5.8.
3. Pictograms shall comply with CBC Section 11B-703.6.
4. Symbol of accessibility shall comply with CBC Section 11B-703.7.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
   1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
   1. Panel Signs: Full-size Samples of each type of sign required.
   2. Approved samples will not be returned for installation into Project.

E. Qualification Data: For Installer.

F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

D. All tactile signage must be field inspected after installation per CBC 11B-703.1.1.2.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
   1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signage fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Best Sign Systems Inc. (Basis of Design)
   2. Apco Graphics Inc.
   3. ASI Sign Systems, Inc.
   4. Curcio Enterprises, Inc.
   5. Mohawk Sign Systems.
   6. Sign A Rama.
   7. Or equal.

B. Exterior Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Gemini, Inc. (Basis of Design)
   2. A.R.K. Ramos Mfg. Co., Inc.
   3. La Haye Bronze.
   4. Metal Arts; Division of L & H Mfg.
   5. Mills Manufacturing. Inc.
   6. Southwell Co.
   7. Or equal.

2.2 PANEL ROOM SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Product: HC300 ADA Sign System by Best Sign Systems.
   1. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished.
   2. No Smoking signs.
   3. Room, Occupancy, Wayfinding Signs: As selected from 4 standard copy size signs.
      a. 4" x 2" with up to 4 characters each.
      b. 6" x 2" with up to 8 characters each.
      c. 8" x 2" with up to 12 characters each.
      d. 10" x 2" with up to 14 characters each.
   4. Toilet Room Signs: As selected from manufacturer's standard.
   5. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
   6. Material:
      a. 1/4 inch thick (thicker than standard) "MP", acrylic sheet, ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
   7. Copy: Contracted grade 2 Braille all capital letter on tactile sign.
      a. Font and Size: As indicated on Drawings.

2.3 PARKING/TRAFFIC SIGNS

A. Material: 0.080" porcelain-enameled aluminum unframed signs, screen printed copy.

B. Accessible signs are blue with white symbol.
   1. Text: Symbols of accessibility, accessible direction, etc. as indicated on Drawings.
   2. Text: Stop, Yield, Do Not Enter, etc. as indicated on Drawings.

C. Post: 2 inch diameter, schedule 40 galvanized pipe.

2.4 EXTERIOR BUILDING SIGN

A. Cast metal letters: Melted metal alloy poured into a mold. The backside is hollow.

B. Size and letters: As indicated on Drawings.

2.5 ACCESSORIES

A. Mounting Methods: Use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead

expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
   2. Signs placed on glazed surfaces, backing sign of the same material and color shall be applied on the opposite glazed surface.

B. Wall-Mounted Panel Signs:
   1. Interior Signs on Smooth Substrates:
      a. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
   2. Exterior and Interior Signs on Rough Substrates:

a. Mechanical Fasteners: Mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
   1) Fastener: Stainless steel screws, tamper-resistant flat head countersink.
   2) Anchors: Suitable for secure attachment to substrate.

C. Parking and Traffic Signs
   1. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
   2. Install sign level, plumb, and at height indicated.
   3. Cap post with galvanized cap.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by District.

END OF SECTION 101400

SECTION 102600 – WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Corner guards.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.

B. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated.
   1. Include similar Samples of accent strips and accessories involving color selection.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Wall Guards: 12 inches long. Include examples of joinery, corners, and field splices.

D. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
   2. Warranty Period: 5 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Corner Guards: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Koroseal. (Basis of Design)
   2. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   3. Construction Specialties (C/S), Inc.
   4. Balco, Inc.
   5. Pawling Corporation.
   6. Or equal.

2.2 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.
   1. Use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.3 CORNER GUARDS

A. Product: Korogard GS Series Stainless Steel Corner Guard by Koroseal or equal.
   1. Stainless Steel Corner Guards:
      a. Stainless Steel 90°/90° Bullnose 3.5 inch.
      b. Size: As indicated on Drawings.

2.4 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Remove tool and die marks and stretch lines or blend into finish.
   2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall-protection units in locations and at mounting heights indicated on Drawings.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean covers.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Toilet accessories.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Elements of Sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
   2. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609.
   3. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
      a. 1-1/2” between the grab bar and the wall.
      b. 1-1/2” minimum between the grab bar and projecting objects below and at the ends.
      c. 12” minimum between the grab bar and projecting objects above.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in California Electrical Code, NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for 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 the Work.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace toilet and bath accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toilet and Bath Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Bobrick Washroom Equipment, Inc. (District Standard)

B. Underlavatory Guards: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Handy-Shield by Plumberex Specialty Products, Inc. (Basis of Design)
   2. IPS Corp.
   3. TCI Products.
   4. Truebro, Inc.
   5. Or equal.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 TOILET ACCESSORIES

A. As indicated on Drawings.

2.4 UNDERLAVATORY GUARDS

A. Product: Handy-Shield Maxx by Plumberex Specialty Products, Inc. or equal.
   1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
   2. PVC insulator shall be 1/8" thick.
   3. Meets Testing Standard ASTM E 84-07 per CBC Chapter 8.
      a. 25 flame spread.
      b. 450 smoke index.
   4. Surfaces to be soft, smooth, non-absorbent, easy to clean U/V inhibited, antimicrobial, antifungal properties.
   5. Insulator shall have a dual fastening system which consists of fusion bonded Velcro fastener strips for full slit enclosure and tamper resistant, smooth, non-abrasive snap-locking fasteners.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate OFCI items with District.

B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.
   3. Mounting brackets for fire extinguishers.

1.2 SYSTEM DESCRIPTION

A. Fire Extinguisher Cabinets:
   1. Fire Extinguisher Cabinets must comply with CBC Sections11B-305, 11B-307, 11B-308, and 11B-309.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.
   2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.

C. Samples for Verification: For each type of exposed factory-applied color finish required for fire-protection cabinets, prepared on Samples of size indicated below.
   1. Size: 6 by 6 inches square.

D. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10-1998 Edition, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: 6 years.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers and Cabinets: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. JL Industries, Inc. (Basis of Design)
   2. Larsen's Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries, Inc.
   4. Ansul.
   5. Or equal.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick minimum.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Valves: Manufacturer's standard.
   2. Handles and Levers: Manufacturer's standard.

3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
4. Certification Tag: Provide fire extinguisher with valid certification test tag where fire extinguishers are fully charged and ready to be used.

B. Dry Chemical Type: Cast steel tank, with pressure gage.
1. Class 2A-20B:C.
2. Nominal Capacity: Provide largest capacity fire extinguisher but 10 lbs. minimum.
3. Finish: Baked enamel, red color.
4. Use: At mechanical rooms and where indicated.

2.4 FIRE-PROTECTION CABINET

A. Product: Cosmopolitan series - stainless steel fire extinguisher cabinet by JL.
1. Door and Trim Construction: No. 4 stainless steel. Flush cabinet doors with a 5/8" door stop are attached by a continuous hinge and equipped with zinc-plated handle and roller catch.
2. Trim Style and Depth: Provide semi-recessed where recessed can’t be provided.
a. Recessed: 3/8" flat trim.
b. Semi-Recessed: 1-1/4", 1-1/2" Square Edge or 2-1/2", 3", 4" (recessed pull), 4-1/2" Rolled Edge.
3. Finish: #4 Stainless Steel.
4. Tub: Constructed of cold rolled steel with white powder-coat finish standard. Surface mount tubs are No 4 stainless.
5. Fire-Rated: At fire-rated assembly.
6. Door Styles: View Door Styles at Right.
7. Door Glazing: Tempered Glass.

2.5 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1. Color: Red.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter.
a. Orientation: Vertical.

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material.
a. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STAINLESS-STEEL FINISHES

A. General: Remove tool and die marks and stretch lines or blend into finish.
   1. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Bright, Directional Polish: No. 4 finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where cabinets will 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.

3.2 PREPARATION

A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated on Drawings.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104400

SECTION 129314 - BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the bicycle racks.

1.2 SUBMITTALS

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

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Size: Not less than 6-inch- long linear components and 4-inch- square components.

D. Product Schedule: Use same designations indicated on Drawings.

E. Maintenance Data: For site furnishings to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of site furnishings that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bicycle Racks:
   1. Dero Bike Racks. (Basis of Design)
   2. Belson Outdoors.
   3. Saris Cycling Group.

4. Or equal.

2.2 BICYCLE RACKS

A. Product: Ultra Space Saver Single by Dero Bike Racks or equal.
   1. Material:
      a. Hanger is 1” diameter tube with ½” steel rod and retaining disk at each end.
      b. Upright is 2” square tube.
      c. Feet are AISI C3 x 4.1 galvanized steel channel.
      d. Crossbeams are 1.25” sched. 40 galvanized pipe (1.660” OD).
      e. Spacers are 2.375” OD plastic tubes with .218” wall thickness.
   2. Factory Finish Process: After fabrication hot dipped galvanized finish with powder coat.
      a. Sandblast.
      b. Epoxy primer electrostatically applied.
      c. Final thick TGIC polyester powder coat.
      d. Color: As selected by Architect from manufacturer’s full range.
   3. Installation: As indicated on Drawings.
   4. Quantity: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

3.3 CLEANING

A. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 129314

SECTION 13 31 23 - PRE-ENGINEERED FABRIC SHADE STRUCTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. A single, State of California-licensed fabric shade structure contractor shall be responsible for the design, wet-stamped engineering drawings, fabrication, supply, and erection of the work specified herein, including foundations. The intent of this specification is to have only one shade contractor be responsible for all of the functions listed above.

1.3 SUBMITTALS

1.3.1 With Bid Submittals:

A. Provide proof of existing reference sites with structures of similar project scope and scale, and that are engineered to and approved to DSA specifications and hold a current PC number.

B. Provide a minimum of 7 fabric samples to demonstrate fabric color range, and a digital (PDF) or paper document showing a minimum of 9 powder coat color choices. Also, provide a letter of authorization from the fabric manufacturer delineating authorized use of the specified fabric.

C. Provide proof of all quality assurance items including:

1. Approved DSA PC engineering with a current site specific approved “A” number.

2. A list of at least 3 reference projects in California that have been installed a minimum of 12 years.

3. Proof of General Liability, Professional Liability, and Umbrella insurance, as per Section 1.4B.

4. Proof of current State of California Contractor’s License, Class A or Class B.

5. Proof of current City of Los Angeles Approved Fabricator license.

6. Proof of a minimum of $15,000,000 aggregate bonding capacity.

7. Proof of current IAS certification, as per Section 1.4D.

8. Proof of an Annual Maintenance Inspection Program.

9. Proof of a Corporate Safety and/or Injury & Illness Prevention Program.

1.4 QUALITY ASSURANCE

Fabrication and erection are limited to firms with proven experience in the design, fabrication, and erection of fabric shade structures, and such firms shall meet the following minimum requirements. No substitutions shall be allowed for the following:

A. A single shade structure contractor shall design, engineer, manufacture, and erect the fabric shade structures, including the foundations, and shall provide a dedicated Project Manager throughout the entire Scope of Work related to the shade structure(s).

B. All bidders shall have at least 15 years' experience in the design, engineering, manufacture, and erection of fabric shade structures, engineered to California Building Code requirements with similar scope, and a successful construction record of in-service performance.

C. All bidders shall provide proof with bid submittal of a minimum of $1,000,000 General/Public Liability insurance, $3,000,000 Professional Liability (PL) insurance, and additional $5,000,000 Umbrella/Excess Liability insurance.

D. All bidders shall be a currently licensed contractor in the State of California and shall provide proof of a minimum aggregate bonding capacity of $15,000,000 with bid.

E. Manufacturer shall have a City of Los Angeles Approved Fabricator license and be accredited by the IAS (International Accreditation Service) for Structural Steel Fabrication.

F. The fabric shade structure contractor shall have a Corporate Quality Control program/manual, which describes their complete quality assurance program.

G. All bidders must be a current Member Contractor with ISNetworld, which confirms the bidder's strict adherence to Safety, Insurance, Quality, and Regulatory standards.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for fabric shade structure(s) shown on the drawings in relation to the property survey and existing structures and verify locations by field measurements prior to erection of the fabric shade structure(s).

1.6 WARRANTY

A. The successful bidder shall provide a 12-month warranty on all labor and materials.

B. A supplemental warranty from the manufacturer shall be provided for a period of 10 years (pro-rated) on fabric and 10 years on the structural integrity of the steel, from date of substantial completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under the provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 – PRODUCTS

2.1 GENERAL

A. The structures shall consist of 4 point hypar sail shade structures per DSA Pre-Approved PC engineering drawings.

B. The structures shall be manufactured by Shade Structures, Inc., d/b/a USA SHADE & Fabric Structures, or approved equal with valid DSA approval at time of bid that includes the engineering drawings, fabric roof, steel cables, all fasteners, and erection of structure(s), including foundations.

C. Contact: USA SHADE & Fabric Structures
1085 N. Main Street, Suite C
Orange, CA 92867
Phone: 714.427.6981
Attn: Patti Abrecht
patti.abrecht@usa-shade.com

D. To qualify as an approved equal, please submit product documentation, fabric samples, and all quality assurance criteria, as per Section 1.4, at least 10 days prior to bid in order to be considered. No substitutions will be allowed after the deadline. Any approval of alternate manufacturers shall be by addendum prior to the bid date and shall not be allowed without written notification.

E. The fabric shade structure(s) shall conform to the current adopted version of the California Building Code.

F. All fabric shade structures are designed and engineered to meet the minimum of 115mph Wind Load, Risk Category II, Exposure C, and Seismic (earthquake) Load based on Seismic Design Category D, Seismic Risk Category II, and a Live Load of 5psf. All fabric shade structures shall be engineered with a zero wind pass–through factor on the fabric. When ASD Steel Design Method is used based on CBC Section 1605A.3.1, the load combinations Dead Load + 0.75 Live load + 0.75 Wind Load, and 0.6 Dead Load + Wind Load must be analyzed. NO EXCEPTIONS.

G. Steel:

1. All steel members of the fabric shade structure shall be designed in strict accordance with the requirements of the “American Institute of Steel Construction” (AISC) Specifications and the “American Iron and Steel Institute” (AISI) Specifications for Cold-Formed Members and manufactured in a IAS- (International Accreditation

Service) accredited facility for Structural Steel Fabrication under CBC Section 1704.2.5.2.

2. All connections shall have a maximum internal sleeving tolerance of .0625" using high-tensile strength steel sections with a minimum sleeve length of 6".

3. All non-hollow structural steel members shall comply to ASTM A-36. All hollow structural steel members shall be cold-formed, high-strength steel and comply with ASTM A-500-10, Grade B. All steel plates shall comply with ASTM A-572, Grade 50. All galvanized steel tubing shall be triple-coated for rust protection using an in-line electroplating coat process. All galvanized steel tubing shall be internally coated with zinc and organic coatings to prevent corrosion.

H. Bolts:

1. All structural field connections of the shade structure shall be designed and made with high-strength bolted connections using ASTM A-325, Grade B.

2. Where applicable, all stainless steel bolts shall comply with ASTM F-593, Alloy Group 1 or 2. All bolt fittings shall include rubber washers for water-tight seal at the joints. All nuts shall comply with ASTM F-594, Alloy Group 1 or 2.

I. Welding:

1. All shop-welded connections of the fabric shade structure shall be designed and performed in strict accordance with the requirements of the "American Welding Society" (AWS) Specifications. Structural welds shall be made in compliance with the requirements of the "pre-qualified" welded joints, where applicable and by certified welders. No onsite or field welding shall be permitted.

2. All full penetration welds shall be continuously inspected by an independent inspection agency and shall be tested to the requirement of current adopted version of the CBC.

J. Powder Coating:

1. Galvanized steel tubing preparation prior to powder coating shall be executed in accordance with solvent cleaning SSPC-SP1. Solvents such as water, mineral spirits, xylol, and toluol, which are to be used to remove foreign matter from the surface. A mechanical method prior to solvent cleaning, and prior to surface preparation, shall be executed according to Power Tool Cleaning SSPC-SP3, utilizing wire brushes, abrasive wheels, needle gun, etc.

2. Carbon structural steel tubing preparation prior to powder coating shall be executed in accordance with commercial blast cleaning SSPC-SP6 or NACE #3. A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, mill scale, rust, coating, oxides, corrosion, and other foreign material.

3. Powder coating shall be sufficiently applied (minimum 3 mils thickness) and cured at the recommended temperature to provide proper adhesion and stability to meet salt spray and adhesion tests, as defined by the American Society of Testing Materials.

4. Raw powder used in the powder coat process shall have the following characteristics:
   a. Specific gravity: 1.68 +/- 0.05
   b. Theoretical coverage: 114 +/- 4ft^2/mil
   c. Mass loss during cure: <1%
   d. Maximum storage temperature: 80ºF
   e. Interpon® 800 is a high-durability TGIC powder coating designed for exterior exposure. Tested against the most severe specifications, Interpon 800 gives significantly improved gloss retention and resistance to color change.

5. When the fabric shade structure(s) will be located within 15 miles of the ocean or standing body of water, rust protection undercoat primer will be required on all structures. Sherwin-Williams® POWDURA® epoxy powder coating Z.R Primer shall be applied in accordance with the manufacturer's specifications. Primer should be fused only and then top coated with the selected powder coat to ensure proper inter-coat adhesion.

   a. The primer's attributes shall be:
      a. Specific gravity (g/ml): 2.37
      b. Coverage at 1.0 mil (ft^2/lb): 81.6
      c. Adhesion: ASTM D-3359 5B
      d. Flexibility: ASTM D-552 Pass 1/8"
      e. Pencil hardness: ASTM D-3363 H-2H
      f. Impact resistance (in.lb): ASTM D-2794 Dir & Rev, 120 in-lbs
      g. Salt spray resistance: ASTM B-117 2000 hours
      h. Humidity resistance: ASTM D-4585 2000 hours
      i. 60° Gloss: ASTM D-523 50 ~ 70
      j. Cure schedule (metal temp): 10min @ 200°C (390°F)
         25min @ 135°C (275°F)
      k. Film thickness tange (mils): 2.0 ~ 3.0

K. Tension Cable: Steel wire rope cable is determined based on calculated engineering loads.

1. 0.25" (nominal) galvanized 7x19 strand core wire rope shall be used for tension loads up to 4,500 lbs.

2. 0.375" (nominal) galvanized 7x19 strand core wire rope shall be used for tension loads up to 9,000 lbs.

3. 0.5" (nominal) galvanized 6x19 strand core wire rope shall be used for tension loads up to 13,500 lbs.

L. Fabric Roof Systems:

1. UV Shade Fabric:

a. Colourshade® FR shade fabric is made of a UV-stabilized, high-density polyethylene (HDPE), as manufactured by Multiknit® (Pty) Ltd. HDPE mesh shall be a heat-stentered, three bar Rachel-knitted, lockstitch fabric with one monofilament and two tape yarns to ensure that the material will not unravel if cut. Raw fabric rolls shall be 9.8425 feet wide.
b. Fabric Properties:
   ~ Life Expectancy: minimum 8 years with continuous exposure to the sun
   ~ Fading: minimum fading after 5 years (3 years for Red)
   ~ Fabric Mass: 5.31 oz/yd^2 ~ 5.6 oz/yd^2 (180gsm ~ 190gsm)
   ~ Fabric Width: 9.8425 feet (3m)
   ~ Roll Length: 164.04 feet (50m)
   ~ Roll Dimensions: 62.99 inches x 16.5354 inches (160cm x 42cm)
   ~ Roll Weight +/- 66 lbs (+/- 30kg)
   ~ Minimum Temp: -13°F (-25°C)
   ~ Maximum Temp: +176°F (80°C)
c. Fabric shall meet the following flame spread and fire propagation tests:
   1) ASTM E-84
   2) NFPA 701 Test Method 2
   3) California's Office of the State Fire Marshal, Registered Flame Resistant Product

2. Stitching & Thread:
   a. All sewing seams are to be double-stitched.
   b. The thread shall be GORE® TENARA® mildew-resistant sewing thread, manufactured from 100% expanded PTFE (Teflon™). Thread shall meet or exceed the following:
      1) Flexible temperature range
      2) Very low shrinkage factor
      3) Extremely high strength, durable in outdoor climates
      4) Resists flex and abrasion of fabric
      5) Unaffected by cleaning agents, acid rain, mildew, salt water, and is unaffected by most industrial pollutants
      6) Treated for prolonged exposure to the sun
      7) Rot resistant

3. Shade and UV Factors:
   a. Shade protection and UV screen protection factors shall be as follows:

Color	UV Block %	Shade %
Pacific Blue	85%	80%~86%
Rain Forest Green	85%	79%~86%
Red	86%	80%~83%
Silver	81%	80%~85%
Desert Sand	92%	80%~84%
Terracotta	82%	80%~83%
Yellow	89%	80%~82%

PART 3 – EXECUTION

3.1 INSTALLATION

A. The installation of fabric shade structures shall be performed by manufacturer or manufacturer-approved and certified contractor, which shall be bonded and holding a current contractor's license with the State of California's Contractors State License Board. All installation personnel must have experience in the erection of tensioned fabric structures.

B. The installation shall comply with the manufacturer's instructions for assembly, installation, and erection, per DSA approved drawings.

C. Concrete:

1. Unless noted otherwise for footings and piers by the Project Engineer, the concrete specification for footings, piers, slabs, curbs, and walkways shall meet a minimum 3,000psi at 28-day strength.

2. Concrete work shall be executed in accordance with the latest edition of American Concrete Building Code ACI 318-14.

3. Concrete specifications shall comply in accordance with the Section 03300 Cast-in-Place Concrete, detailed as per plans, and shall be as follows:
   a. 28 Days Strength F'c = 3000 psi
   b. Aggregate: HR
   c. Slump: 3 ~ 5 inch
   d. Portland Cement shall conform to C-150
   e. Aggregate shall conform to ASTM C-33

4. All reinforcement shall conform to ASTM A-615 grade 60.

5. Reinforcing steel shall be detailed, fabricated, and placed in accordance with the latest ACI Detailing Manual and Manual of Standard Practice.

6. Whenever daily ambient temperatures are below 80 degrees Fahrenheit, the contractor may have mix accelerators and hot water added at the batch plant (See Table 1).

7. The contractor shall not pour any concrete when the daily ambient temperature is to be below 55 degrees Fahrenheit.

TABLE 1

Temperature Range	% Accelerator	Type Accelerator
75~80 degrees F	1%	High Early (non calcium)
70~75 degrees F	2%	High Early (non calcium)
Below 70 degrees F	3%	High Early (non calcium)

D. Foundations:

1. All anchor bolts set in new concrete shall comply with ASTM F1554 GR 55.

2. All anchor bolts shall be Hot-Dip Galvanized.

3. Footings and full rebar cages shall be drilled, set and poured as per manufacturer's specifications. All foundations shall be installed per final DSA approved manufacturer's engineered specifications and drawings.

END OF SECTION 13 31 23

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

1.4 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.

7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.12 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40°C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:
1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 05 13

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during

installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of

comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
c. Include all pertinent construction, installation, performance and technical data.
d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

    1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
    2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this

and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.13 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 SLEEVES: Shall be plastic or galvanized steel where pipes pass through concrete walls or floor slabs.

A. Isolate pipes through ground floor slabs with Kraft paper, plastic tape or similar materials unless conduit is specified or indicated.

B. Sleeves for pipes through exterior walls shall be non-metallic with minimum 2" weep ring as manufactured by Link Seal. Pipe shall be sealed with Link Seal modular seal with EPDM seal elements.

C. Sleeves in or through fire rated walls shall be per U.L. Fire Resistance System No. WL1146 for drywall construction, and U.L. Fire Resistance System No. CAJ1044 for concrete construction. See architectural plans for all locations of rated walls.

D. Below-grade piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts and sleeves as manufactured by Century Line.

E. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

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

G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

4. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 22 05 17

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during

installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of

comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
c. Include all pertinent construction, installation, performance and technical data.
d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

    1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
    2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this

and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.13 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
    f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.
8. Sight flow indicators.

B. Related Sections:

1. Section 211313 "Wet-Pipe Sprinkler Systems"
2. Section 221116 "Domestic Water Piping" for water meters inside the building.

1.3 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.4 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Palmer Wahl Instrumentation Group.

7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ashcroft Inc.
   b. Marsh Bellofram.
   c. Miljoco Corporation.
   d. Palmer Wahl Instrumentation Group.
   e. REOTEMP Instrument Corporation.
   f. Trerice, H. O. Co.
   g. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.

10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

2.3 LIGHT-ACTIVATED THERMOMETERS

A. Direct-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flo Fab Inc.
    b. REOTEMP Instrument Corporation.
    c. Trerice, H. O. Co.
    d. Weiss Instruments, Inc.
    e. WIKA Instrument Corporation - USA.
    f. Winters Instruments - U.S.

2. Case: Metal; 7-inch or 9-inch nominal size unless otherwise indicated.
3. Scale(s): Deg F.
4. Case Form: Adjustable angle.
5. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
6. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

7. Display: Digital.
8. Accuracy: Plus or minus 2 deg F.

B. Remote-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Miljoco Corporation.
    b. Weiss Instruments, Inc.
    c. Winters Instruments - U.S.

2. Case: Plastic, for wall mounting.
3. Scale(s): Deg F.
4. Sensor: Bulb and thermister wire.

    a. Design for Thermowell Installation: Bare stem.

5. Display: Digital.
6. Accuracy: Plus or minus 2 deg F.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.

k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

C. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Miljoco Corporation.
d. Noshok.
e. Palmer Wahl Instrumentation Group.
f. REOTEMP Instrument Corporation.
g. Tel-Tru Manufacturing Company.
h. Trerice, H. O. Co.
i. Weiss Instruments, Inc.
j. WIKA Instrument Corporation - USA.
k. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish one test-plug kit containing one thermometer, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1 to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F .

D. High-Range Thermometer: Small, bimetallic insertion type with 1 to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2 to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200.

F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

B. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

C. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

D. Install remote-mounted pressure gages on panel.

E. Install valve and snubber in piping for each pressure gage for fluids.

F. Install test plugs in piping tees.

G. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Outlet of mixing valves with access panel.

H. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

3.2 CONNECTIONS

A. Install meters adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 to 100 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bronze ball valves.
2. Ductile-iron, single-flange butterfly valves.
3. Bronze lift check valves.
4. Bronze swing check valves.
5. Bronze gate valves.
6. Iron gate valves
7. Manual circuit balancing valves.

B. Related Sections:

1. Division 2 water distribution piping Sections for general-duty and specialty valves for site construction piping.
2. Division 15 plumbing piping Sections for specialty valves applicable to those Sections only.
3. Division 15 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the

engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be

neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.12 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61-G and NSF-372 for valve materials for potable-water service.

1. Valves for domestic water must comply with the Federal Reduction of Lead in Drinking Water Act.
   a. "Lead Free" refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤ 0.25%.
   b. All valves must be 3rd party certified.
   c. Bronze valves shall be made of dezincification-resistant material.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.14 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and

sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.16 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Piping systems shall be supplied with valves arranged so as to give complete and regulating control of each building and piping systems throughout the building, and located so all parts are easily accessible and maintained.

1. Valve Design: Rising stem or outside screw and yoke stems. Non-rising stem valves may be used where space conditions prevent full extension of rising stems.
2. Sizes: Same size as upstream pipe, unless otherwise indicated.
3. Extended stems: Where piping insulation is indicated or specified, valves shall be equipped with 2” extended handles of non-thermal conductive material. Also provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Supply with memory stops, which are fully adjustable after insulation is applied.
4. End Connection: 2 inch and under shall be threaded, 2-1/2 inches and larger shall be flanged or full lug style.

C. Valves for Potable Water must comply with California Lead Free Law, effective January 1, 2010.

1. "Lead Free" refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤ 0.25%. Source: California Health & Safety Code (116875).
2. All valves must be 3rd party certified.
3. Bronze valves shall be made with dezincification-resistant material.

D. Where possible, valves of one manufacturer shall be used.

E. Provide Class 150 valves meeting the valve specifications where Class 125 valves are specified but are not available.

F. Bronze valves shall be made with dezincification-resistant materials, (Bronze ASTM B62, B61, or B584 Alloy C87850). This includes body, ball, stem and / or trim.

G. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

H. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

I. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

J. Valve Sizes: Same as upstream piping unless otherwise indicated.

K. Valve Actuator Types:

1. Hand-wheel: For valves other than quarter-turn types.
2. Hand-lever: For quarter-turn valves NPS 6 and smaller.

L. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

a. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Nib-seal handle extension or comparable product by one of the following:

b. General valves:

1) NIBCO
2) Hammond
3) Milwaukee

c. Below grade domestic water shut-off valves (gate valves) 2" and larger:

1) NIBCO.
2) Clow.
3) Mueller.

d. Butterfly Valves:

1) NIBCO.
2) Demco.
3) Dezuric.

e. Plug Valves:

1) Hammond.
2) Milwaukee.

f. Check valves, lift type:

1) Hammond.
2) Milwaukee.

g. Below grade backwater valve isolation valves:

1) NIBCO.
2) Clow.
3) Mueller.

2. Butterfly Valves: With extended neck.

M. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

N. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim & Nib-Seal Handle:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-595-Y-66-LF or T-595-Y-66-LF or a comparable product by one of the following,

a. Milwaukee Valve Company.
b. Apollo.

2. Description:

c. Standard: MSS SP-110, NSF 61-G.
d. CWP Rating: 600 psig.
e. Body Design: Three piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
f. Body Material: Bronze ASTM B 584 Alloy C87850 or C87600.

g. Ends: Threaded or Solder.
h. Seats: PTFE or TFE.
i. Stem: 316 Stainless steel.
j. Ball: 316 Stainless steel, vented.
k. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim & Nib-Seal Handle:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-585-66-LF or T-585-66-LF or a comparable product by one of the following:

a. Conbraco Industries, Inc.; Apollo Div.
b. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110, NSF 61-G.
b. CWP Rating: 600 psig.
c. Body Design: Two piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
d. Body Material: Bronze ASTM B 584 Alloy C87600.
e. Ends: Threaded or Solder.
f. Seats: PTFE or TFE.
g. Stem: 316 Stainless steel.
h. Ball: 316 Stainless steel, vented.
i. Port: Full.

C. 200 CWP, Sizes 2-1/2" – 24", Ductile Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model LD-2000-3/5, or a comparable product by one of the following:

a. Cooper Cameron Corp.; Cooper Cameron Valves Div.
b. Tyco International, Ltd.; Tyco Valves & Controls

2. Description:

a. Standard: MSS SP-67, Type I, IAPMO.
b. NPS 24 (DN 300) and Smaller CWP Rating: 200 psig (1380 kPa).
c. Body Design: Full Lug type; Bubble tight shutoff, suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze

D. Retain one or more of six paragraphs in this article if iron, single-flange butterfly valves are required. MSS SP-67 covers iron, single-flange butterfly valves NPS 1-1/2 to NPS 72.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-480-Y-LF or T-480-Y-LF or a comparable product by one of the following:

a. Hammond.
b. Milwaukee.

2. Description:

a. Standard: MSS SP-80, Type 2, NSF 61-G.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 584 Alloy C87850, lead free bronze.
e. Ends: Threaded or Solder.
f. Disc: PTFE, or TFE.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Nonmetallic TFE Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-Y-LF or T-413-Y-LF or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Powell Valves.

2. Description:

a. Standard: MSS SP-80, Type 4, NSF 61-G.
b. CWP Rating: 200 psig.
c. Body Design: Y-pattern Horizontal flow.
d. Body Material: ASTM B 584 Alloy C87850, lead free bronze.
e. Ends: Threaded or Solder.
f. Disc: PTFE or TFE.

2.5 BRONZE GATE VALVES

A. NRS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-113-LF or T-113-LF or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Powell Valves.

2. Description:

a. Standard: MSS SP-139, Type 2, NSF 61-G.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 584, dezincification-resistant bronze with integral seat and threaded bonnet.
d. Ends: Threaded or Solder.
e. Stem: Lead free Silicon Bronze.
f. Disc: Solid wedge; lead free bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

B. RS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-111-LF or T-111-LF or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Powell Valves

2. Description:
a. Standard: MSS SP-80, Type 2, NSF 61-G.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B584 C87850 dezincification resistant bronze with integral seat and threaded bonnet.
d. Ends: Threaded or Solder.
e. Stem: Lead free silicon bronze.
f. Disc: Solid wedge, lead free bronze.
g. Packing: Asbestos free.
h. Handwhell: Malleable iron.

2.6 IRON GATE VALVES

A. Class 125, Ductile-Iron Resilient Wedge Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-619-RWS (NRS) or F-607-RWS (OS&Y) or a comparable product by one of the following:

a. Clow
b. Mueller

2. Description:

a. Standard: AWWA C-509 and C-515,
b. CWP Rating: 300 psig.
c. Body Material: ASTM A-536 ductile iron, fusion-bonded epoxy coating inside and out.
d. Ends: Flanged.
e. Trim: stainless steel.
f. Disc: Rubber encapsulated ductile iron wedge.

g. Packing and Gasket: Asbestos free.

2.7 MANUAL CIRCUIT BALANCING VALVES

A. Bronze, Fixed Orifice, Balancing Valves (2” and smaller):

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T/S-1810-LF or a comparable product by one of the following:

   a. Or approved equal

2. Description:

   a. CWP Rating: 300 psig
   b. Maximum Operating Temperature: 260°F.
   c. Body Material: Bronze or dezincification-resistant brass, lead free, Y-pattern globe type with fixed orifice (venture) for precise regulation and control. NO QUARTER TURN VALVES WILL BE ACCEPTED.
   d. Plug: Bronze or dezincification-resistant brass with EPDM O-Rings.
   e. Seat: Bronze or dezincification-resistant brass.
   f. Ends: Threaded or Solder.
   g. Pressure Gage Connections: Shall have two metering test ports with internal check and protective caps for use with portable differential pressure metering stations.
   h. Handle Style: Calibrated hand wheel equipped with visual position readout and hidden memory stops for repeatable regulation and control.

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves (2-1/2” and larger):

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F/G 737A or a comparable product by one of the following:

   a. Tour & Andersson

2. Description:

   a. CWP Rating: 240 psig
   b. Maximum Operating Temperature: 250°F.
   c. Body Material: Cast-iron or steel body, globe pattern with calibrated orifice. NO BUTTERFLY VALVES.
   d. Stem Seals: EPDM O-Rings
   e. Disc: EPDM coated cast-iron disc.
   f. Seat: Bronze or dezincification brass.
   g. Ends: Flanged or grooved.
   h. Pressure Gage Connection: Integral seals for portable differential pressure meter.
   i. Handle Style: Calibrated hand wheel equipped with visual position readout and concealed memory stops for repeatable regulation and control.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior 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. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.

3. Throttling Service: Ball or Butterfly valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: Threaded ends.
2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
3. Bronze Lift Check Valves: Class 125, nonmetallic TFE disc.
4. Bronze Swing Check Valves: Class 150, nonmetallic TFE disc.
5. Bronze Gate Valves: Class 150, RS.

B. Pipe NPS 2-1/2 and Larger:

1. Ductile-Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

END OF SECTION 22 05 23

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.6 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.7 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of

the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.13 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.14 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.16 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Pipe Supports: Unless otherwise indicated on the drawings, shall be as follows:

A. The Contractor shall furnish and install all miscellaneous iron work including angles, channels, etc., required to appropriately support the various piping systems. Hanger spacing and location shall conform to 2022 California Plumbing Code Table 313.1.

B. All horizontal runs of piping within the building to be supported from the structural framing with steel rods and split ring hangers, B-Line, Grinnell Company, Tolco, or approved equal. Steel rods shall be secured to overhead framing with side beam connectors. Where necessary, install angle iron between framing to accommodate hanger rods. Where several pipes are running together, Unistrut, B-Line or Powerstrut channels with clamps may be used in lieu of individual pipe hangers, and supported from structure as herein specified. Submit test data for type of hanger supports to be provided. For support conditions other than specified herein, the Contractor shall submit method of support for approval prior to any installation.

C. Horizontal Piping Hangers and Supports:

1. General: Provide factory fabricated horizontal hangers and supports complying with one of the following MSS types listed to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. 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.

    a. Adjustable Steel Clevis Hangers: (MSS Type 1.) B-Line B 3100
    b. Adjustable Swivel Pipe Rings: (MSS Type 5) B-Line B3690

D. Vertical-Piping Clamps:

1. General: Provide factory fabricated vertical-piping clamps complying with the following types listed, 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.
2. Two-Bolt Riser Clamps: (MSS Type 8) B-Line B3373

E. Hanger-Rod Attachments:

1. General: Provide factory fabricated hanger-rod attachments B-Line, Tolco or approved equal, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-58 and manufacturer's published product information. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
2. Side beam eye socket, Tolco Fig. #57 for rod sizes 3/8" dia. and Tolco Fig. #25-30-251 for rod sizes 1/2" dia.

F. Building Attachments:

1. General: Provide factory fabricated building attachments, selected by Installer to suit building structural framing 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.

G. Hanger Rods and Spacing shall conform to the following table:

Pipe Sizes	Spacing	Rods
2 Inch and Smaller	6 Feet	3/8 Inch
2-1/2 Inch to 3 Inch	8 Feet	1/2 Inch
4 Inch and larger	8 Feet	5/8 Inch

H. Hangers and Supports shall be adequate to maintain alignment and prevent sagging and shall be placed within 18 inches of joint. Support shall be provided at each horizontal branch connection.

I. Provide lateral bracing as manufactured by B-Line or approved equal for all piping to prevent swaying or movement in accordance with SMACNA "Guidelines for Seismic Restraints of Piping Systems". Piping smaller than indicated in the guidelines shall be provided with bracing

as specified for the smallest size indicated. The entire water distribution system shall be properly braced and will not move due to the action of quick closing of valves.

J. Miscellaneous Supports, Wall Brackets, Etc.: Provide where required in accordance with the best standard practices of the trade. Submit shop drawings for all fabricated supports.

2.2 Isolators. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator. Isolators shall be B-Line vibra clamp and cushion, Super Strut, Stoneman "Trisolator", or approved equal. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.

2.3 Shields:

A. General: Provide shields at piping hangers and supports, factory-fabricated, for all insulated piping as manufactured by Pipeshields Incorporated or approved equal. Size shields for exact fit to mate with pipe insulation.

1. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation or equal 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.

2.4 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.5 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ERICO International Corporation.
2. PHS Industries, Inc.
3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
4. Piping Technology & Products, Inc.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.

4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 22 05 29

SECTION 220553 - IDENITIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2019 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and

mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

F. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of

the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

G. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit

detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.12 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations,

plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: White.
   b. Letter Color: Black.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: White.
   b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:

   a. Cold Water: Natural.
   b. Hot Water: Natural.

3. Letter Color:

   a. Cold Water: Black.
   b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.11 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.12 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.13 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.14 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.15 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.16 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.17 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for

installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.18 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Hot Water Pipe Insulation: All hot water supply and return piping, except exposed connections to plumbing fixtures, flanges and unions shall be insulated with ASTM C547, Class I, "Johns-Manville" "Micro-Lock" 850-APT, Owens-Corning Fiberglass Corp., ASJ/SL-11 or approved equal, 1" thick for sizes up to 1" and 1-1/2" thick for sizes 1 1/4" and larger with “Johns-Manville” “Zeston” pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2022 CMC

1. Exposed insulated piping in occupied areas and exposed outside the building shall be covered with Johns-Manville” “Zeston” 30-mil thick white PVC jacketing material per ASTM D1784 with “Johns-Manville” “Zeston” pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Jacketing shall comply with ASTM E84, and shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2022 CMC.
2. Hot water piping below slab shall have insulation protected by a 10-mil thick polyethylene plastic sleeve sealed watertight with poly vinyl chloride tape.

B. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armacell LLC; Tubolit.
b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

I. Condensate Pipe Insulation: All condensate piping within the building shall be insulated with "Imcoa" "Imcolock" ¾” nominal wall thickness closed-cell insulation. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2022 CMC. All joints shall be mitered and secured with black duct tape.

J. All insulation shall be continuous through supports and hangers.

K. All fixtures complying with the provisions of the Americans with Disabilities Act shall be provided with Prowrap insulation for exposed hot water pipe, tailpiece, and trap as manufactured by McGuire, and secured per manufacturers recommendations. No tape wrapping shall be permitted.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide the following:

   a. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.4 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. McGuire Manufacturing.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for

above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. NPS 1” and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1” inch thick.

2. NPS 1-1/4” and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 1/2" inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. McGuire pre-insulated trap and supply covers.

END OF SECTION 22 07 19

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 UTILITIES

A. See Drawings for Points of Connection.

B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.

C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.

D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite domestic water system.

1.8 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.13 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.14 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

F. Piping within the building and above grade shall be Type "L" ASTM B88, hard drawn copper tubing with wrought copper sweat fittings ANSI B16.18 and B16.22.

G. Outdoor underground piping in sizes 2-1/2" and 3" shall be Type "L" ASTM B88, hard drawn copper as specified for water piping within the building. Piping 2" and smaller shall be Type "K" ASTM B88, hard drawn copper with wrought copper sweat fittings ANSI B16.18 and B16.22.

H. Piping below the building floor shall be Type "K" soft annealed copper tubing with no fittings below the slab.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. For service shut-off valves on domestic water; for pressure regulator assemblies, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type
2. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.5 CORROSION PROTECTION:

1. General.

   a. Corrosion protection shall be provided for all below grade copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

2. Materials.

   a. Copper piping encasement.

      1) The polywrap shall be minimum 6 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall conform to the requirements of ASTM D1248.
      2) The polywrap shall be as manufactured by Northtown Company or approved equal.

   b. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

Pipe Size / Type	Polywrap Flat Tube Width
½” to ¾” copper	2”
1” to 1-½ copper	3”
2” copper	4”
2-1/2” copper	5”
3” copper	6”

c. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.

1) Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.

d. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

D. Install shutoff valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level without pitch and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

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

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

S. Corrosion Protection:

1. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the poly-wrap. The bunched-up poly-wrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the poly-wrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.
2. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.
3. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 72 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3: 8 feet with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.5 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 PIPE AND EQUIPMENT IDENTIFICATION

A. Each operating and service line shut-off valve shall be identified by a 19 ga. brass tag with stamped, engraved type of service identified and area served, complete with hole and brass chain mounted on valve stem or handle. Tag shall be a minimum of one and one-half inch (1-1/2") in diameter.

B. All piping systems shall be readily identifiable by appropriate labeling with the name of the piping contained. Such labeling shall be by means of metal tags, stenciling, stamping, or with adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft and at least once in each room and each story traversed by the piping system.

C. Provide on exterior wall of each building opposite the building's main gas service a sign reading "Gas Shut Off". Sign shall be metal with minimum 1-1/2" high-embossed letters.

1. All equipment shall be provided with name plate indicating all pertinent information on it

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

Schedule of Test Pressures:

System Tested	Gauge	Test	Duration
Water	100 PSI	Water	4 Hours

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Operate all valves during the retention period.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours. Operate all valves during the retention period.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 OPERATION INSTRUCTION

A. Prior to occupancy or prior to the date of final inspection, whichever may occur first, the Contractor shall prepare two (2) sets of typewritten instructions for the operation of all equipment, valves, etc., specified and furnished as a part of the work under this section, and shall assign a competent person, thoroughly familiar with the job, to demonstrate and instruct a representative of the Owner in the operation of the equipment. The time of said demonstration and instructions shall be arranged with the Owner's representative approximately one (1) week in advance. Verbal instructions shall include shut-off location of gas and water. The Contractor shall assemble all operation and maintenance data supplied by the manufacturers of the various pieces of equipment, all keys and special wrenches required to operate and service the equipment (including keys for yard boxes, gas stops and fixture stops), and all equipment warranties and deliver same to the representative of the Owner on date of said instructions.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly valves with flanged ends for piping NPS 2-1/2 and larger.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Balancing valves.
3. Temperature-actuated, water mixing valves.
4. Hose bibbs.
5. Water-hammer arresters.
6. Trap-seal primer valves.
7. Trap-seal primer systems.

B. Related Requirements:

1. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
2. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
3. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
4. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
5. Section 224713 "Drinking Fountains" for water filters for water coolers.
6. Section 224716 "Electric Water Coolers" for water filters for water coolers.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

A. See Drawings for Points of Connection.

B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.

C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.

D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite domestic water system.

E. Domestic Water Service: The Contractor shall arrange with the serving utility company for the installation of all water meter assemblies and reduced pressure backflow devices, including the service mains and vaults, and all required appurtenances as indicated on the drawings and in accordance with serving utility standards and shall pay all costs incurred. All required capacity fees, frontage fees and inspections, shall be paid for by the Owner. Contractor shall provide necessary tap-in connections in water main for sterilizing of domestic water system. Contractor shall connect into the main water service line as indicated on the drawings. The installation shall be in accordance with the serving utility company's standards.

1.9 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.

d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were

selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.14 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.15 GUARANTEES (Also see General Conditions)

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.16 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

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

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1001.
4. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

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

    a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    b. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    c. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
    d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1011.
4. Body: Bronze, nonremovable, with manual drain.
5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
6. Finish: Rough bronze.

C. Pressure Vacuum Breakers:

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

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1020.
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 5 psig maximum, through middle third of flow range.
6. Size: See plans.
7. Design Flow Rate: See plans.
8. Selected Unit Flow Range Limits: See plans.
9. Accessories:

    a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

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

    a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    b. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1035.
4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10) matching faucet size.
5. Body: Bronze.
6. End Connections: Threaded.
7. Finish: Chrome plated.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

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

    a. Armstrong International, Inc.
    b. NIBCO Inc.
    c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Type: Ball valve with two readout ports and memory-setting indicator.
4. Body: Brass or bronze.
5. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
6. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

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

   a. Armstrong International, Inc.
   b. NIBCO Inc.
   c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
4. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

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

   a. Symmons Industries, Inc.
   b. Bradley.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig (860 kPa).
5. Type: Thermostatically controlled, water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded[**union**] inlets and outlet.
8. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Tempered-Water Setting: 120°F.
10. Tempered-Water Design Flow Rate: 0.35 GPM.
11. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Symmons Industries, Inc.
   b. Bradley.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig (860 kPa)minimum unless otherwise indicated.
5. Type: Exposed-mounted or Cabinet-type (Refer to Plumbing Fixture Schedule), thermostatically controlled, water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded[**union**] inlets and outlet.
8. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Tempered-Water Setting: 120°F.
10. Tempered-Water Design Flow Rate: 0.35 GPM.
11. Selected Valve Flow Rate at 45-psig (310-kPa) Pressure Drop: 0.35 GPM.
12. Valve Finish: Rough bronze.
13. Piping Finish: Copper.
14. Cabinet: Factory fabricated, stainless steel, for recessed or surface **(**Refer to Plumbing Fixture Schedule) mounting and with hinged, stainless-steel door.

C. Individual-Fixture, Water Tempering Valves:

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

   a. Symmons Industries, Inc.
   b. Bradley.

3. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
4. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded.
8. Finish: Rough or chrome-plated bronze.
9. Tempered-Water Setting: 110°F**.**
10. Tempered-Water Design Flow Rate: 0.35 GPM.

D. Primary Water Tempering Valves:

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

   a. Symmons Industries, Inc.
   b. Bradley.

3. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
4. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
5. Body: Bronze.
6. Temperature Control: Manual.
7. Inlets and Outlet: Threaded.
8. Selected Primary Water Tempering Valve Size: See plans.
9. Tempered-Water Setting: 120°F**.**
10. Tempered-Water Design Flow Rate: See plans.
11. Tempered-Water Outlet Size: See plans for end connection.
12. Cold-Water Inlet Size: See plans for end connection.
13. Hot-Water Inlet Size: See plans for end connection.
14. Valve Finish: Rough bronze.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Include operating key with each operating-key hose bibb.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Precision Plumbing Products, Inc.
    b. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. MIFAB, Inc.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.9 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Precision Plumbing Products, Inc.

2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

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

6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Four.
8. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water-hammer arresters in water piping according to PDI-WH 201.

B. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

C. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 Access Panels:

A. Wall access panels shall be minimum 12" x 12" for concealed valves and other equipment unless otherwise specified or indicated. Ceiling access panels shall be 18" x 18" minimum. Access panels shall be located and positioned for ready access and service of equipment housed within. Where access panels are specified with keyed cylinder locks, all such locks shall be identically keyed.
   1. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-CL, drywall, stainless steel finish, cylinder lock.
   2. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
   3. Wall, Fire Rated: Elmdor/Stoneman FR-SS-CL, fire rated, stainless steel finish, cylinder lock.
   4. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.

3.3 Yard Boxes & Vaults: For service shut-off valves on gas and domestic water; for pressure regulator assemblies and for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

3.4 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.5 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Supply-type, trap-seal primer valves.
   2. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.7 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:
1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

A. See Drawings for Points of Connection.

B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.

C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.

D. Sanitary Sewer: The Contractor shall be responsible for the soil and waste piping outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite sewer system.

1.9 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be

neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

    1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.14 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.15 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

1.16 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.17 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.18 GUARANTEES (Also see General Conditions)

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. ASTM C 1540, Heavy Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky SD 4000 series.
   b. MIFAB MI-QXHUB.

2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Soil and waste piping within the building itself and outside within five feet (5') of the foundation, shall be no-hub cast iron pipe and fittings, asphaltum coated, free from defects, and shall comply with CISPI. Standard 301, ASTM A-888 or ASTM A-74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Fittings shall be made up with "Husky" SD 4000 series or “MIFAB MI-QXHUB” series stainless steel type 304 couplings and shall conform to ASTM C1540 & ASTM C564 except all above ground vent pipe fittings may be made with "Anaco" or "MIFAB" stainless steel two band couplings conforming to CISPI Standard 310.

D. Except where otherwise indicated on the plans, building sewer piping from five feet (5') outside of the building to connections at the sewer shall be PVC (polyvinyl chloride) ASTM D3034, SDR-35 sewer pipe with locked-in gasket (ASTM F477, Elastomeric Seal.

E. Grease waste piping underground shall be cast iron pipe and fittings as specified for soil and waste piping.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Cleanouts to Grade: Jay R. Smith No. 4258 or Jay R. Smith No. 4253 with X-H bronze plug and X-X-H non-skid cover with lifting device set flush with surface for concrete areas. Asphalt or nonsurfaced areas shall be installed with ring of concrete poured around the bottom flange six inches (6") below surface. Use cast iron soil pipe on cleanout risers. For cleanouts in non-traffic areas, terminate cleanout plug in concrete yard box
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Smith, Jay R. Mfg. Co.
    b. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

3. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
4. Top-Loading Classification(s): Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty.
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Yard Boxes & Vaults: For service for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

2.4 CORROSION PROTECTION

A. General.

1. Corrosion protection shall be provided for all below grade cast iron and copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

B. Materials.

1. Cast iron piping encasement.

    a. The polywrap shall be minimum 8 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall meet or exceed the requirements of AWWA C105, ANSI A21.5 and ASTM A674.
    b. The polywrap shall be as manufactured by Northtown Company or approved equal.

2. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

Pipe Size / Type	Polywrap Flat Tube Width
2” to 3” cast iron	14”
4” cast iron	16”

6” cast iron	20”
8” cast iron	24”

3. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.

    a. Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.

4. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

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

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.

2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with

closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

T. Below-grade piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts and sleeves as manufactured by Century Line.

U. Corrosion Protection:

a. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the polywrap. The bunched-up polywrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the polywrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.
b. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.
c. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body

to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. No piping work shall be concealed or covered until piping has been tested, inspected and approved by the Inspector. All piping for plumbing systems shall be completely installed and tested as required by the Uniform Plumbing Code. Test pressures and times indicated are a minimum only. All tests shall be as required by the governing authority as wellTest for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Aboveground, vent piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

D. Underground, soil, waste, and vent piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION 22 13 16

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section 224300 "Medical Plumbing Fixtures" for plaster sink interceptors.
3. Section 334100 "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. HDPE: High-density polyethylene plastic.

1.4 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.7 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated

hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Grease interceptors.

B. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

   a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
   b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
   c. Include all pertinent construction, installation, performance and technical data.
   d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

C. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were

selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that grease interceptors, accessories, and components will withstand seismic forces defined in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.14 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.15 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.16 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.17 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.18 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.19 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate size and location of roof penetrations.

1.20 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. bottles.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zurn
b. JR Smith
c. Watts

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zurn
b. JR Smith
c. Watts

2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Threaded.
7. Closure: Brass plug with tapered threads.
8. Adjustable Housing Material: Cast iron with set-screws or other device.

9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Zurn
   b. JR Smith
   c. Watts

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Option for drilled-and-threaded plug in first subparagraph below is for a screw for a wall cover plate.
6. Closure: Countersunk, brass plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
9. Wall Access: stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

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

   a. Zurn
   b. JR Smith
   c. Watts

3. Standard: ASME A112.6.3.
4. Pattern: Floor drain.
5. Body Material: Gray iron.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Outlet: Bottom.
10. Coating in first subparagraph below is usually used only on sanitary floor drains.
11. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
12. Sediment Bucket: Not required.

13. Top or Strainer Material: Nickel bronze.
14. Top of Body and Strainer Finish: Nickel bronze.
15. Top Shape: Round.

B. Stainless-Steel Floor Drains:

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

   a. Josam Company.

3. Standard: ASME A112.3.1.
4. Outlet: Bottom.
5. Top or Strainer Material: Stainless steel.
6. Top Shape: Round.
7. Trap-Primer Connection: Required.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Install grease interceptors on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete." Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment"
3. Comply with requirements for vibration isolation devices specified in Section 22 05 48.13 "Vibration Controls for Plumbing Piping and Equipment."

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

N. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

O. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

P. Install wood-blocking reinforcement for wall-mounting-type specialties.

Q. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 62 00 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 22 13 19

SECTION 221413 - STORM DRAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 221429 "Sump Pumps" for storm drainage pumps.
2. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.
2. Storm Drainage, Force-Main Piping: 150 psig.

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

A. See Drawings for Points of Connection.

B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.

C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.

D. Storm Drain: The Contractor shall be responsible for the storm drain service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite storm drain system.

1.9 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve

headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

   a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

      1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

   b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.14 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.15 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky SD 4000 series.
b. MIFAB MI-QXHUB.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Storm Drain Piping:

1. Concealed storm drain piping within the building itself and outside within five feet (5') of the foundation, shall be no-hub cast iron pipe and fittings, asphaltum coated, free from defects, and shall comply with CISPI. Standard 301, ASTM A-888 or ASTM A-74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Fittings shall be made up with "Husky" SD 4000 series or “MIFAB MI-QXHUB” series stainless steel type 304 couplings and shall conform to ASTM C 1540 & ASTM C564.
2. Exposed storm drain piping shall be Schedule 40 galvanized steel pipe, ASTM A53, with black cast iron recessed drainage fittings.

D. Sub-soil Drainage System:

1. Piping: PVC, SDR-35 perforated pipe with solid wall fittings and solvent-cemented joints. Perforations shall be 1/4" diameter on 3" centers, 120 degrees between two rows parallel to pipe axis. Install per pipe manufacturer's directions.
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Cleanouts to Grade: Jay R. Smith No. 4258 or Jay R. Smith No. 4253 with X-H bronze plug and X-X-H non-skid cover with lifting device set flush with surface for concrete areas. Asphalt or nonsurfaced areas shall be installed with ring of concrete poured around the bottom flange six inches (6") below surface. Use cast iron soil pipe on cleanout risers. For cleanouts in non-traffic areas, terminate cleanout plug in concrete yard box

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Smith, Jay R. Mfg. Co.
b. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

3. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
4. Top-Loading Classification(s): Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty.

5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Yard Boxes & Vaults: For service for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

2.4 CORROSION PROTECTION:

1. General.

a. Corrosion protection shall be provided for all below grade cast iron piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

2. Materials.

a. Cast iron piping encasement.

1) The polywrap shall be minimum 8 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall meet or exceed the requirements of AWWA C105, ANSI A21.5 and ASTM A674.

2) The polywrap shall be as manufactured by Northtown Company or approved equal.

b. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

Pipe Size / Type	Polywrap Flat Tube Width
2” to 3” cast iron	14”
4” cast iron	16”
6” cast iron	20”
8” cast iron	24”
10” cast iron	27”
12” cast iron	30”
15” cast iron	37”

c. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.

1) Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.

d. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

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

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of

lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1% downward in direction of flow for piping NPS 3 and smaller; 1% downward in direction of flow for piping NPS 4 and larger unless noted otherwise on drawings.
2. Horizontal Storm-Drainage Piping: 1% downward in direction of flow unless noted otherwise on drawings.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

O. Install steel piping according to applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install engineered siphonic drain specialties and storm drainage piping in locations indicated.

R. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

S. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

T. Install force mains at elevations indicated.

U. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

Z. Corrosion Protection:

a. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the polywrap. The bunched-up polywrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the polywrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

b. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

c. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

K. Install supports for vertical copper tubing every 10 feet.

L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3 : 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

M. Install supports for vertical ABS and PVC piping every 48 inches.

N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor.
3. Comply with requirements for backwater valves cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Connect force-main piping to the following:

1. Storm Sewer: To exterior force main.
2. Sump Pumps: To sump pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 14 13

SECTION 221423 - STROM DRAIN PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Flashing materials.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.
2. Storm Drainage, Force-Main Piping: 150 psig.

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each

submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.13 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.14 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without Architect's written permission.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Solder: ASTM B 32, lead-free alloy.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

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

    a. Zurn
    b. JR Smith
    c. Watts

3. Standard: ASME A112.6.4, for general-purpose roof drains.
4. Body Material: Cast iron.
5. Dimension of Body: Nominal 15-inch diameter.
6. Combination Flashing Ring and Gravel Stop: Required.
7. Outlet: Bottom.
8. Extension Collars: Required.
9. Underdeck Clamp: Required.
10. Sump Receiver Plate: Required.
11. Dome Material: Cast iron.
12. Perforated Gravel Guard: Stainless steel.
13. Vandal-Proof Dome: Required.
14. Overflow Drain Water Dam: 2 inches.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adaptors:

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

B. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.

C. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.3 CLEANOUTS

A. Floor Cleanouts:

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

   a. Zurn
   b. JR Smith
   c. Watts.

3. Standard: ASME A112.36.2M, for adjustable housing cleanouts.
4. Size: Same as connected branch.
5. Type: Adjustable housing.
6. Body or Ferrule Material: Cast iron.
7. Clamping Device Required.
8. Outlet Connection: Spigot.
9. Closure: Cast-iron plug.
10. Adjustable Housing Material: Cast iron with threads
11. Frame and Cover Material and Finish: Stainless steel.
12. Frame and Cover Shape: Round.
13. Top-Loading Classification: Heavy Duty.
14. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Test Tees:

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

   a. Zurn

b. JR Smith
c. Watts

3. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
4. Size: Same as connected drainage piping.
5. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure Plug: Countersunk.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts:

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

a. Zurn
b. JR Smith.
c. Watts

3. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
4. Size: Same as connected drainage piping.
5. Body Material Hubless, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure: Countersunk or raised-head cast-iron plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
9. Wall Access: Round stainless-steel wall-installation frame and cover.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

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

a. ProSet Systems Inc.

3. Standard: ASTM E 814, for through-penetration firestop assemblies.
4. Certification and Listing**:** Intertek Testing Service NA for through-penetration firestop assemblies.
5. Size: Same as connected pipe.
6. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
7. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

8. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M,12 oz./sq. ft.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install test tees in vertical conductors and near floor.

F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23

SECTION 221616 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Section 221619 “Condensate Drain Piping Specialties" for sanitary sewerage piping and structures outside the building.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Single-Wall Piping Pressure Rating: 10-foot head of water.

A. Delegated Design: Design seismic restraints for aboveground piping, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each

submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.13 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.14 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

1.15 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.16 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.17 GUARANTEES (Also see General Conditions)

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Indirect Waste Piping.

1. Shall be Type "L" copper as specified for water piping.

C. Air Conditioning Condensate Drain Piping.

1. Shall be Type "M" copper as specified for water piping.

2.2 COPPER TUBE AND FITTINGS:

A. Hard Copper Tube: ASTM B 88, Type M tube, drawn temper.

B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends

2.3 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of condensate drain piping. Indicated locations and arrangements are used to size pipe and

calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install condensate drain piping with 1 percent slope downward toward drain.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping at indicated slopes.

G. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated

H. Install piping free of sags and bends.

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

J. Install piping to allow application of insulation.

K. Install unions in copper tubing at connection to each piece of equipment, machine, and specialty.

L. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 72 inches with 3/8-inch rod.

2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:

1. Plumbing Specialties: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Install test tees (wall cleanouts) in conductors near floor.

3. Equipment: Connect drainage piping as indicated. Provide union for each connection.

C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

D. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed condensate drain piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
        2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

    c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

    a. Fill condensate drain piping. Check components to determine that they are not air bound and that piping is full of water.
    b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    d. Cap and subject piping to static water pressure of 50 psig. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    f. Prepare reports for tests and for corrective action required.

B. Condensate drain piping will be considered defective if it does not pass tests and inspections

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, condensate drain piping NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type M copper, soilder-joint fittings; and soldered joints.

END OF SECTION 22 16 16

SECTION 223300 - ELECTRIC DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.12 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

1.13 QUALITY ASSURANCE

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

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.14 COORDINATION

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

1.15 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.16 WARRANTY

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Two years.

b. Compression Tanks: Five years.
c.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AO Smith
    b. Bradford White
    c. Rheem
    d. Lochinvar

2. Standard: UL 1453.

3. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    c. Insulation: Comply with ASHRAE/IESNA 90.1.
    d. Jacket: Steel with enameled finish.
    e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
    f. Temperature Control: Adjustable thermostat.
    g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.

2.2 domestic-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

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

    a. AMTROL Inc.
    b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    c. Taco, Inc.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

F. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

G. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing

Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill electric, domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 22 33 00

SECTION 22421313 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.
9. 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.
10. All single-user toilet facilities shall be identified as a Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.2.6.3. no pictogram, text or braille is required on the symbol. If a tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are “ALL-GENER RESTROOM”, “RESTROOM’, OR “UNISEX RESTROOM”. DSA BU 17-01.

11. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
12. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
13. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
14. Accessible fixture controls shall comply with CBC Sections 11B-604.6 for water closets and 11B-604.9.5 for children's water closets.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each

submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

1.12 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include

locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES (Also see General Conditions)

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets: Floor mounted, bottom outlet, top spud.

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

a. American Standard America.
b. Kohler Co.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Standard.
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. (4.8 L) per flush.
h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

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

    a. Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. (4.8 L) per flush.
10. Minimum Inlet: NPS 1 (DN 25).
11. Minimum Outlet: NPS 1-1/4 (DN 32).

2.3 TOILET SEATS

A. Toilet Seats:

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

    a. Bemis Manufacturing Company.
    b. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.

B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed

or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

C. Fixture controls shall comply with CBC Sections 11B-604.6 for water closets

END OF SECTION 22 42 13 13

SECTION 22421613 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.
9. 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.
10. All single-user toilet facilities shall be identified as a Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.2.6.3. no pictogram, text or braille is required on the symbol. If a tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are “ALL-GENER RESTROOM”, “RESTROOM’, OR “UNISEX RESTROOM”. DSA BU 17-01.
11. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.

12. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
13. Accessible fixture controls shall comply with CBC Sections 11B-611.3 for lavatories and sinks.
14. 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 an toe clearance provided in accordance with CBC 11B-306 when forward approach is required CBC Sections 11B-606.3 and 11B606.7.
15. 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 or sinks. CBC Section 11B-606.5.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each

submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1.12 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built

information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Vitreous china, wall mounted, with back.

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

a. American Standard America.
b. Kohler Co.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Faucet-Hole Location: Top.
d. Color: White.
e. Mounting Material: Chair carrier.

3. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier.

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, single-control mixing, commercial, solid-brass valve.

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

    a. Chicago Faucets.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Material: Commercial, solid brass.
5. Finish: Polished chrome plate.
6. Mounting Type: Deck, exposed.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

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

    a. Chicago

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

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

    a. Chicago

E. Operation: Loose key.

F. Risers:

1. NPS 3/8.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.

B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

G. Point of use mixing valve in cabinet to be recessed in wall, under lavatory.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

C. Fixture controls shall comply with CBC Sections 11B-606.4 for lavatories and sinks.

D. Accessible sinks shall be 6-1/2” deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34” maximum above the finish floor or ground.

E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

END OF SECTION 22 42 16 13

SECTION 22421616 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Classroom Sinks
2. Sinks
3. Service sinks.
4. Sink faucets.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.
9. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
10. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
11. Accessible fixture controls shall comply with CBC Sections 11B-611.3 for lavatories and sinks.
12. 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 an toe clearance provided in accordance with CBC 11B-306 when forward approach is required CBC Sections 11B-606.3 and 11B606.7.

13. 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 or sinks. CBC Section 11B-606.5.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of

submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers’ submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division

except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
    b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
    c. Include all pertinent construction, installation, performance and technical data.
    d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

        1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
        2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

    e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

    a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

        1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

    b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1.12 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Equipment and Fixtures:

A. Fixtures:

1. See schedule on drawings.

2.2 CLASSROOM SINKS

A. Utility Sinks: White enameled cast iron counter mounted.

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

a. Haws Manufacturing.
b. Just Manufacturing.

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Ledge back.
c. Number of Compartments: One
d. Overall Dimensions: 25 by 17 inches
e. Metal Thickness: 0.050 inch
f. Compartment:

1) Dimensions: See Plumbing Fixture Schedule
2) Drain: Grid with NPS 1-1/2 tailpiece with stopper
3) Drain Location: Centered in compartment.

2.3 SINKS

A. Utility Sinks: Stainless steel, counter mounted.

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

a. Elkay Manufacturing Co.
b. Just Manufacturing.

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Ledge back.
c. Number of Compartments: One
d. Overall Dimensions: 22 by 19 inches
e. Metal Thickness: 0.050 inch
f. Compartment:

1) Dimensions: See Plumbing Fixture Schedule
2) Drain: Grid with NPS 1-1/2 tailpiece with stopper
3) Drain Location: Centered in compartment.

3. Faucet(s): See Plumbing Fixture Schedule

a. Number Required: One.
b. Mounting: On ledge.

2.4 SERVICE SINKS

A. Service Sinks: Enameled, cast iron, floor mounted.

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

a. Commercial Enameling Company (CECO).
b. American Standard America.
c. Kohler Co.

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2.
b. Style: With front apron and raised back.
c. Nominal Size: 28 by 28 inches.
d. Color: White.
e. Drain: Grid with NPS 3 outlet.
f. Rim Guard: Coated wire.

2.5 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual Type, Push Button.

1. Commercial, Solid-Brass Faucets.

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

1) Chicago Faucets.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Material: Commercial, solid brass.
5. Finish: Chrome plated.
6. Maximum Flow Rate:

a. Sinks: 1.8 gpm.
b. Service Sinks: - gpm

7. Mounting Type: Back/wall, exposed.
8. Vacuum Breaker: Required for hose outlet.
9. Spout Outlet: Hose thread according to ASME B1.20.7.

2.6 SINK BUBBLER

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Bubbler: Manual Type, Push Button.

1. Commercial, 304 Stainless Steel Bubbler.

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

1) Just Manufacturing.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Cold-water indicators; coordinate bubbler inlets with supplies and fixture hole punching’s; coordinate outlet with spout and sink receptor.
4. Body Material: Commercial, solid brass.
5. Finish: Highly buffed/mirror.
6. Mounting Type: Deck mounted, exposed.
7. Spout Outlet: Conforms with:

a. SDF/ANSI 61/9 – Annex G
b. AB1953 compliant

2.7 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

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

a. Chicago

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

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

a. Chicago

E. Operation: Loose Key.

2.8 SINK WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

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

a. McGuire MFG.

2. Size: NPS 1-1/2.
3. Material: Chrome-plated, seamless prewrapped cast-brass trap and swivel elbow, and chrome-plated brass or steel wall flange.

2.9 SERVICE SINK WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 3 offset and straight tailpiece.

C. Trap:

1. Size: NPS 3.
2. Material: Flat Chrome strainer, cast-brass trap and swivel elbow.

2.10 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.

B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

3.6 Completion of Installation:

A. Cleaning and Flushing: Clean all equipment and materials thoroughly. Leave surface to be painted smooth and clean, ready for painting.

B. Flush each unit of water supply and distribution system thoroughly with clean water at the highest velocities attainable.

C. Clean all piping, valves, traps, water heaters, fixtures and other devices thoroughly and flush or blow out until free of scale, oil silt, sand, sediment, pipe dope and foreign matter of any kind.

3.7 PLUMBING FIXTURES

A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

C. Fixture controls shall comply with CBC Sections 11B-606.4 for lavatories and sinks.

D. Accessible sinks shall be 6-1/2” deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34” maximum above the finish floor or ground.

E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

END OF SECTION 22 42 16 16

SECTION 224713 - DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes drinking fountains and related components.

1.3 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2022 CPC).
2. 2022 California Plumbing Code.
3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
4. National Fire Protection Association.
5. California Division of the State Architect.
6. California State Division of Industrial Safety.
7. County Health Department.
8. Any other legally constituted body-having jurisdiction thereof.
9. Access plumbing fixtures shall comply with all of the requirements of CBC Division 6.
10. Heights and location of all fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
11. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and

mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:

    a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
c. Include all pertinent construction, installation, performance and technical data.
d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the

requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

1.13 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.14 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains: Stainless steel, pedestal mounted.

1. Stainless-Steel Drinking Fountains:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    1) Haws Corporation.

3. Type Receptor: On concrete slab.
4. Bubblers: Two located on deck.
5. Control: Push button.
6. Drain: Grid type with NPS 1-1/2 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
9. Support: ASME A112.6.1M, Type III lavatory carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

C. Fixture controls shall comply with CBC Sections 11B-601.3 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-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

D. Accessible sinks shall be 6-1/2” deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34” maximum above the finish floor or ground.

E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

3.7 PLUMBING FIXTURES

A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

C. Fixture controls shall comply with CBC Sections 11B-601.3 for drinking fountains.

D. Accessible sinks shall be 6-1/2” deep maximum. Sinks shall be mounted with front of the higher of the rim and counter surface 34” maximum above the finish floor or ground.

E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

END OF SECTION 22 47 13

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 230548 "Vibration and Seismic Controls for HVAC for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Spring hangers.
3. Restraint channel bracings.
4. Restraint cables.
5. Seismic-restraint accessories.
6. Mechanical anchor bolts.

1.3 DEFINITIONS

A. CBC: California Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES OR an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.

h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: elastomeric.

a. Surface Pattern: Smooth pattern.
b. Infused nonwoven cotton or synthetic fibers.

2.2 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.
e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.3 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.4 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.5 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.6 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES OT an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

B. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

C. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction that provides required submittals for component.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction that provides required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, manufacturer, model number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

F. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in other sections.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Orange.
b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. All Valve-Tags: 1-1/2 inches minimum, round.

2. Valve-Tag Color:

a. All Valve-Tags: Natural.

3. Letter Color:
a. All Valve-Tags: Black.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. TAB: Testing, adjusting, and balancing.

C. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.

4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. TAB Conference: Meet with Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

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. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine 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.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. 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.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Isolating and balancing valves are open and control valves are operational.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

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.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

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. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 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. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. 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, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, 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.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to 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; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- 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.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, 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. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

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. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor 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. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.

j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

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. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor 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. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.

c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
c. Verify that balancing devices are marked with final balance position.
d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner.
3. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 – DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Friendly Feel Duct Wrap.
    d. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
   b. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.

b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
c. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.8 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CHP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. C & F Wire.

2.10 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.

2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, supply-air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 3.0-lb/cu. Ft. nominal density.

B. Concealed, return-air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 3.0-lb/cu. Ft. nominal density.

C. Concealed, outdoor-air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 3.0-lb/cu. Ft. nominal density.

D. Exposed, supply-air duct and plenum insulation shall be the following:

1. Internally lined per Section 233113 “Metal Ducts.”

E. Exposed, return-air duct and plenum insulation shall be the following:

1. Internally lined per Section 233113 “Metal Ducts.”

F. Exposed, outdoor-air duct and plenum insulation shall be the following:

1. Internally lined per Section 233113 “Metal Ducts.”

3.11 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Outdoor, supply-air duct and plenum insulation shall be the following:

1. Internally lined per Section 233113 “Metal Ducts.”

C. Outdoor, return-air duct and plenum insulation shall be the following:

1. Internally lined per Section 233113 “Metal Ducts.”

D. Outdoor, outdoor-air duct and plenum insulation shall be the following:

1. Internally lined per Section 233113 “Metal Ducts.”

END OF SECTION 230713

SECTION 230719 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Refrigerant piping, indoors and outdoors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
3. Detail removable insulation at piping specialties.
4. Detail application of field-applied jackets.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

N. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe

insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

F. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

G. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, and three locations of fittings for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material.

B. Piping:

1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 230719

SECTION 23 09 00 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:
   1. Section 230519 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
   2. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. MS/TP: Master slave/token passing.

D. PC: Personal computer.

E. PID: Proportional plus integral plus derivative.

F. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
   2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
   3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
   4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.

5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
    a. Water Temperature: Plus or minus 1 deg F.
    b. Water Flow: Plus or minus 5 percent of full scale.
    c. Water Pressure: Plus or minus 2 percent of full scale.
    d. Space Temperature: Plus or minus 1 deg F.
    e. Ducted Air Temperature: Plus or minus 1 deg F.
    f. Outside Air Temperature: Plus or minus 2 deg F.
    g. Dew Point Temperature: Plus or minus 3 deg F.
    h. Temperature Differential: Plus or minus 0.25 deg F.
    i. Relative Humidity: Plus or minus 5 percent.
    j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
    k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
    l. Airflow (Terminal): Plus or minus 10 percent of full scale.
    m. Air Pressure (Space): Plus or minus 0.01-inch wg.
    n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
    o. Carbon Monoxide: Plus or minus 5 percent of reading.
    p. Carbon Dioxide: Plus or minus 50 ppm.
    q. Electrical: Plus or minus 5 percent of reading.

1.5 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
    1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
    2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
    3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
    2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
    3. Wiring Diagrams: Power, signal, and control wiring.
    4. Details of control panel faces, including controls, instruments, and labeling.
    5. Written description of sequence of operation.

6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:
   a. Wiring diagrams for control units with termination numbers.
   b. Schematic diagrams and floor plans for field sensors and control hardware.
   c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

1.6 INFORMATIONAL SUBMITTALS

A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

B. Qualification Data: For Installer and manufacturer.

C. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

D. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
   2. Interconnection wiring diagrams with identified and numbered system components and devices.
   3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
   4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   5. Calibration records and list of set points.

B. Software and Firmware Operational Documentation: Include the following:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
   3. Device address list.

4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 135 for DDC system components.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.10 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Section 281600 "Intrusion Detection" to achieve compatibility with equipment that interfaces with that system and with building master clock.

C. Coordinate equipment with Section 281300 "Access Control" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate equipment with Section 275313 "Clock Systems" to achieve compatibility with equipment that interfaces with that system.

E. Coordinate equipment with Section 284619 "PLC Electronic Detention Monitoring and Control Systems" to achieve compatibility with equipment that interfaces with that system.

F. Coordinate equipment with Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" to achieve compatibility with equipment that interfaces with that system.

G. Coordinate equipment with Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System" to achieve compatibility with equipment that interfaces with that system.

H. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

I. Coordinate equipment with Section 260913 "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

J. Coordinate equipment with Section 262416 "Panelboards" to achieve compatibility with starter coils and annunciation devices.

K. Coordinate equipment with Section 262419 "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

L. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturer specified.

2.2 CONTROL SYSTEM

A. Manufacturers:
   1. Carrier i-Vu.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

D. Control system shall include the following:
   1. Building intrusion detection system specified in Section 281600 "Intrusion Detection."
   2. Building clock control system specified in Section 275313 "Clock Systems."
   3. Building lighting control system specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
   4. Fire alarm system specified in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."

2.3 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
      d. Software applications, scheduling, and alarm processing.
      e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
   3. Standard Application Programs:
      a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
      b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
      c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
      d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
      e. Remote communications.
      f. Maintenance management.
      g. Units of Measure: Inch-pound and SI (metric).
   4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
   3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
   1. Binary Inputs: Allow monitoring of on-off signals without external power.
   2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
   3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
   4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
   5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
   6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
   7. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
   1. Output ripple of 5.0 mV maximum peak to peak.
   2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
   3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
   1. Minimum dielectric strength of 1000 V.
   2. Maximum response time of 10 nanoseconds.
   3. Minimum transverse-mode noise attenuation of 65 dB.
   4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
   1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
   2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
   3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
   4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
   5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.5 ALARM PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch-thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
   1. Alarm Condition: Indicating light flashes and horn sounds.
   2. Acknowledge Switch: Horn is silent and indicating light is steady.
   3. Second Alarm: Horn sounds and indicating light is steady.
   4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
   5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.6 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
   1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
   1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
   2. Proportional band shall extend from 2 to 20 percent for 5 psig.
   3. Authority shall be 20 to 200 percent.
   4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
   5. Gages: 1-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.7 TIME CLOCKS

A. Manufacturers:
1. ATC-Diversified Electronics.
2. Grasslin Controls Corporation.
3. Paragon Electric Co., Inc.
4. Precision Multiple Controls, Inc.
5. SSAC Inc.; ABB USA.
6. TCS/Basys Controls.
7. Theben AG - Lumilite Control Technology, Inc.
8. Time Mark Corporation.

B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.

C. Solid-state, programmable time control with 8 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.8 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:
1. Manufacturers:
   a. BEC Controls Corporation.
   b. Ebtron, Inc.
   c. Heat-Timer Corporation.
   d. I.T.M. Instruments Inc.
   e. MAMAC Systems, Inc.
   f. RDF Corporation.
2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Manufacturers:
   a. BEC Controls Corporation.
   b. MAMAC Systems, Inc.
   c. RDF Corporation.
2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.
   1. Manufacturers:
      a. BEC Controls Corporation.
      b. General Eastern Instruments.
      c. MAMAC Systems, Inc.
      d. ROTRONIC Instrument Corp.
      e. TCS/Basys Controls.
      f. Vaisala.
   2. Accuracy: 2 percent full range with linear output.
   3. Room Sensor Range: 20 to 80 percent relative humidity.
   4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
   6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
   7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:
   1. Manufacturers:
      a. BEC Controls Corporation.
      b. General Eastern Instruments.
      c. MAMAC Systems, Inc.
      d. ROTRONIC Instrument Corp.
      e. TCS/Basys Controls.
      f. Vaisala.
   2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
      a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
      b. Output: 4 to 20 mA.
      c. Building Static-Pressure Range: 0- to 0.25-inch wg.
      d. Duct Static-Pressure Range: 0- to 5-inch wg.
   3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base where indicated in plans.

2.9 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
1. Manufacturers:
a. BEC Controls Corporation.
b. I.T.M. Instruments Inc.

2.10 GAS DETECTION EQUIPMENT

A. Manufacturers:

1. Honeywell International Inc.; Home & Building Control.
2. Sensidyne, Inc.
3. TSI Incorporated.
4. Vulcain Inc.

B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F; with 2 factory-calibrated alarm levels at 35 and 200 ppm.

C. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output;, for wall mounting.

D. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.11 FLOW MEASURING STATIONS

A. Thermal Airflow Station, Air Ducted/Plenum:
1. Manufacturers:
   a. Ebtron, Inc.
   b. Greenheck
   c. Ruskin
2. Description:
   a. Thermal airflow station with one or more sensor nodes mounted in a probe, and a remotely mounted microprocessor-based transmitter at each measurement location.
   b. Sensor nodes with one self-heated and one zero power bead-in-glass thermistor at each sensing node, using the principle of thermal dispersion.
3. Airflow Station Performance:
   a. Independent processing of up to 16 separately wired sensor node assemblies.
   b. Airflow rate and temperature of each sensor is equally weighted and averaged by the transmitter prior to output.
   c. Accuracy: Within 3 percent of reading for ducted applications, within 5 percent of reading for non-ducted applications, when installed in accordance with the manufacturer's recommended placement guidelines. Include the combined uncertainty of the sensor nodes and transmitter. For devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter, demonstrate compliance with the accuracy requirement over the entire operating range.
4. Sensor Node and Probe Assemblies:
   a. Sensor Node Construction: Two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy with sensor housings constructed of glass-filled polypropylene. Construct with only the thermistor located within the sensing node and all other electronic components outside the airstream. Epoxy or glass encapsulated chip thermistors or devices with exposed leads are not allowed.
   b. Performance rated and tested with a 100 percent survival rate in a 30-day saltwater and acid vapor test with written independent laboratory test results.

c. Store sensor node airflow and temperature calibration data in a serial memory chip, in the cable connecting plug. Stored data does not require matching or adjustments to the transmitter in the field.
d. Sensor Node Calibration: Individually calibrated at 16 measurement points to airflow standards directly calibrated at NIST to the NIST Laser Doppler Anemometer (LDA) primary velocity standard.

1) Accuracy: Within 2 percent of reading over the entire calibrated airflow range of 0 to 5,000 fpm .
2) Individually calibrate thermistor at a minimum of 3 temperatures to NIST-traceable temperature standards.

e. Sensing Node Temperature Accuracy: Within 0.15 deg F over an operating range of minus 20 deg F to plus 160 deg F and humidity range of 0 to 100 percent RH.
f. Provide the number of independent sensor nodes as follows:

1) For Duct/Plenum Area up to 0.5 sq. ft. : 1.
2) For Duct/Plenum Area Greater than 0.5 through 1.0 sq. ft. : 2.
3) For Duct/Plenum Area Greater than 1.0 through 2.0 sq. ft. : 4.
4) For Duct/Plenum Area Greater than 2.0 through 4.0 sq. ft. : 6.
5) For Duct/Plenum Area Greater than 4.0 through 8.0 sq. ft. : 8.
6) For Duct/Plenum Area Greater than 8.0 through 12.0 sq. ft. : 12.
7) For Duct/Plenum Area Greater than 12.0 through 14.0 sq. ft. : 14.
8) For Duct/Plenum Area Greater than 14.0 sq. ft. : 16.

g. For an aspect ratio of 1.5 or less, and an area of 25 sq. ft. or greater, 4 probes are required.
h. Sensor Probe Construction: Gold anodized, 6063 aluminum alloy tube, with each sensor probe containing one or more independently wired sensing nodes.
i. Sensor Probe Mounting Bracket Construction: Type 304 stainless steel.
j. Internal Probe Wiring: Kynar coated copper between the connecting cable and sensor nodes.
k. Internal Probe Wiring Connections: Solder joints and spot welds, sealed and protected from the elements, so that direct exposure to water will not affect instrument operation.
l. Sensor Probe Jacket: Integral, FEP jacket, plenum rated CMP/CL2P, UL/cUL-Listed cable, rated for exposures from minus 67 deg F to plus 392 deg F , and for continuous and direct UV exposure.
m. Sensor Probe Cable Connector Plug: Gold plated pins for connection to the transmitter.

5. Transmitter:
a. Transmitter determines the average airflow rate and temperature of connected sensor nodes in an array for a single location.
b. User Interface: 16-character, alpha-numeric, LCD display, with two field selectable analog output signals and network output capability.

1) Two field selectable 0-5/0-10 V dc, or 4-20 mA, scalable, isolated, over-current protected analog output signals. The first output (AO1) provides the total airflow rate. The second output (AO2) is field configurable for temperature or low and/or high airflow set point (user defined) or system status alarm. The RS-485 (BACnet MS/TP, or Modbus RTU) network connection provides the average airflow rate, temperature, high and/or low

airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures.

c. Printed Circuit Board Interconnects: Gold plated edge fingers, receptacle plug pins, and printed circuit board test points.
d. Printed Circuit Boards: Electroless nickel immersion gold (ENIG) plated.
e. Integrated Circuitry: Temperature rated, industrial-grade.
f. Integration Buffers: Separate integration buffers for display of airflow output, airflow signal output (analog and network), and individual sensor output (IR-interface).
g. Transmitter Features and Functions:

1) High and/or low airflow alarm with user-defined set point and percent of set point tolerance.
2) Manual or automatic alarm reset, and low-limit cutoff value may be selected to disable the alarm.
3) Alarm delay function, field defined.
4) Sensor node malfunction via the system status alarm and ignore the sensor node that is in a fault condition.
5) Field configuration, diagnostics, and Field Output Adjustment Wizard that allows for a one- or two-point field adjustment to factory calibration for installations that require adjustment.
6) Automatic reset after power disruption, transients, and brown-outs through a watchdog timer circuit.
7) Operating temperature range of minus 20 deg F to plus 120 deg F and humidity range of 5 to 95 percent RH.
8) Electrical Power Requirement: 24-V ac (between 22.8- and 26.4-V ac under load) at 20-VA maximum, using a switching power supply that is over-current and over-voltage protected.

6. Listing and Certifications:
a. UL/cUL Listing: UL/cUL 873 Listed as an assembly.
b. BTL Listing: BTL Listed, network-capable, airflow stations supplied with RS-485 interface and BACnet protocol.

2.12 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.

6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Manufacturers:
      a. Belimo Aircontrols (USA), Inc.
   2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   3. Dampers: Size for running torque calculated as follows:
      a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
      d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
      e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
      f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
   4. Coupling: V-bolt and V-shaped, toothed cradle.
   5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
   6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
   7. Power Requirements (Two-Position Spring Return): 24-V ac.
   8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
   9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
   10. Temperature Rating: Minus 22 to plus 122 deg F.
   11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
   12. Run Time: 30 seconds.

2.13 CONTROL VALVES

A. Manufacturers:
   1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
   2. Erie Controls.
   3. Hayward Industrial Products, Inc.
   4. Magnatrol Valve Corporation.
   5. Neles-Jamesbury.
   6. Parker Hannifin Corporation; Skinner Valve Division.
   7. Pneuline Controls.
   8. Sauter Controls Corporation.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:
   1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
   2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 5-psig maximum pressure drop at design flow rate or the following:
   a. Two Position: Line size.
   b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: Lug.
2. Disc Type: Epoxy-coated ductile iron.
3. Sizing: 1-psig maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.14 DAMPERS

A. Manufacturers:
1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

B. Dampers: AMCA-rated, parallel-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.15 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Section 271500 "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

B. Verify duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation.
1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:
1. Entrances.
2. Public areas.
3. Where indicated.

E. Install automatic dampers according to Section 233300 "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Section 230553 "Identification for HVAC Piping and Equipment."

H. Install hydronic instrument wells, valves, and other accessories according to Section 232116 Hydronic Piping Specialties."

I. Install steam and condensate instrument wells, valves, and other accessories according toSection 232216 Steam and Condensate Piping Specialties."

J. Install refrigerant instrument wells, valves, and other accessories according to Section 232300 "Refrigerant Piping."

K. Install duct volume-control dampers according to Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts."

L. Install electronic and fiber-optic cables according to Section 271500 "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 260533 "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Section 271500 "Communications Horizontal Cabling."
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install exposed cable in raceway.
   3. Install concealed cable in raceway.
   4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
   5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
   7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Pressure test control air piping at 30 psig or 1.5 times the operating pressure for 24 hours, with maximum 5-psig loss.
5. Pressure test high-pressure control air piping at 150 psig and low-pressure control air piping at 30 psig for 2 hours, with maximum 1-psig loss.
6. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
7. Test each point through its full operating range to verify that safety and operating control set points are as required.
8. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
9. Test each system for compliance with sequence of operation.
10. Test software and hardware interlocks.

C. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. Check DDC system as follows:
    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:
1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.

3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
   a. Check analog inputs at 0, 50, and 100 percent of span.
   b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
   c. Check digital inputs using jumper wire.
   d. Check digital outputs using ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
   a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
   b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
   a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
   b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
   a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
   b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 230900

SECTION 232300 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

A. 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 relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L; ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8.

2.2 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

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

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. 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.
3. Liquid lines may be installed level.

M. 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.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 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.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. SEMCO Incorporated.
    d. Sheet Metal Connectors, Inc.

e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation; Insulation Group.
    b. Johns Manville.
    c. Knauf Insulation.
    d. Owens Corning.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Mason Industries.
5. TOLCO; a brand of NIBCO INC.
6. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by the Office of Statewide Health Planning and Development for the State of California.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 1-inch wg.

C. Return Ducts:

1. Ducts Connected to Air handling unit, and Terminal Units

a. Pressure Class: Positive or negative 1-inch wg.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Air handling unit, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
2. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
3. Supply Fan Plenums: Fibrous glass, Type II, 1-1/2 inches thick.
4. Return-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
5. Transfer Ducts: Fibrous glass, Type I, 1-1/2 inches thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Flange connectors.
5. Turning vanes.
6. Remote damper operators.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Smoke-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
d. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Pottorff.
3. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2500 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: Hat-shaped, 18-gage galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Plated steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Chain pulls.
4. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.
5. Screen Mounting: Rear mounted.
6. Screen Material: Galvanized steel.
7. Screen Type: Bird.
8. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Pottorff.
3. Ruskin Company.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: Hat-shaped, 16-gage, galvanized sheet steel with welded corners or mechanically attached and mounting flange.

F. Blades:

1. Multiple, 0.025-inch- thick, roll-formed alumrinum.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

G. Blade Seals: Vinyl.

H. Blade Axles: Plated steel.

I. Tie Bars and Brackets:

1. Material: Galvanized steel.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Ball.

L. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.5 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Nailor Industries Inc.
b. Pottorff.
c. Ruskin Company.
d. Trox USA Inc.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Frame: Hat-shaped, 20-gage, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Plated steel.
7. Bearings:

a. Molded synthetic.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.8 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Galvanized spiral wire sheath.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Steel.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Greenheck Fan Corporation.
3. Pottorff.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall or double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 11-gage carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.12 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, polyethylene film supported by helically wound, galvanized-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 5500 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

1. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch-diameter steel bars, 6 inches o.c. in each direction

in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with draw bands.

Q. Install duct test holes where required for testing and balancing purposes.

R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Centrifugal roof ventilators.
   2. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

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

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: As required to maintain 12” above finish roof.
3. Sound Curb: Curb with sound-absorbing insulation.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.

2.2 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic or painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 MOTORS

A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of

Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections.
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Modular core, square ceiling diffusers.
2. Perforated diffusers.
3. Adjustable bar grilles.
4. Round diffusers.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Modular Core, Square Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.
   b. Titus.
   c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, color selected by Architect.
5. Face Style: Modular Core.
6. Mounting: Surface.
7. Pattern: Adjustable.

B. Perforated Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.
   b. Titus.
   c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, color selected by Architect.
5. Duct Inlet: Square.
6. Face Style: Flush.
7. Mounting: T-bar.
8. Pattern Controller: Adjustable with louvered pattern modules at inlet.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.
   b. Titus.
   c. Anemostat Products; a Mestek company.

2. Material: Steel.

3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
7. Mounting: Concealed.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 233723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof hoods.
2. Goosenecks.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators will be attached.
2. Sizes and locations of roof openings.

B. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.

E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerovent.
2. Greenheck Fan Corporation.
3. Loren Cook Company.

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Galvanized-steel sheet, minimum 0.064-inch- thick base and 0.040-inch- thick hood; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 12 inches.

E. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.

F. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

G. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.4 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.

B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 18 inches.

C. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.

D. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

E. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.

3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

    a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.

C. Install gravity ventilators with clearances for service and maintenance.

D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.

F. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 233723

SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Heat-pump refrigeration components.
3. Hot-gas reheat.
4. Gas furnace.
5. Economizer outdoor- and return-air damper section.
6. Integral, space temperature controls.
7. Roof curbs.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating

operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Roof openings
3. Roof curbs and flashing.

B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

1.8 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation.
2. Trane; American Standard Companies, Inc.
3. YORK International Corporation.

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Exterior Casing Thickness: 0.052 inch thick.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Galvanized steel, 0.034 inch thick.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1/2 inch
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Formed sections of galvanized steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

D. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.
4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1.

B. Hot-Gas Reheat Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: Minimum 90 percent arrestance, and MERV 13.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented.

E. Safety Controls:

1. Gas Control Valve: Modulating.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.
2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC."

B. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:

a. Heat-cool-off switch.
b. Fan on-auto switch.
c. Fan-speed switch.
d. Automatic changeover.
e. Adjustable deadband.
f. Exposed set point.
g. Exposed indication.
h. Degree F indication.
i. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.

3. Remote Wall-Mounted Annunciator Panel for Each Unit:

a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

C. DDC Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

    a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
    b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."
    c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.

3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
4. Unoccupied Period:

    a. Heating Setback: 50 deg F.
    b. Cooling Setback: System off.
    c. Override Operation: Two hours.

5. Supply Fan Operation:

    a. Occupied Periods: Run fan continuously.
    b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:

    a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
    b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
    c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.

7. Hot-Gas Reheat-Coil Operation:

    a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
    b. Unoccupied Periods: Reheat not required.

8. Gas Furnace Operation:

    a. Occupied Periods: Modulate burner to maintain room temperature.
    b. Unoccupied Periods: Cycle burner to maintain setback temperature.

9. Economizer Outdoor-Air Damper Operation:

    a. Occupied Periods: Open to minimum position as determined during air balancing procedure to obtain code required minimum outside air quantities. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F. Use outdoor-air temperature to adjust mixing dampers. Start relief-air fan with end

switch on outdoor-air damper. During economizer cycle operation, lock out cooling.

b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

10. Carbon Dioxide Sensor Operation:

a. Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

11. VVT Relays:

a. Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system required in Section 233600 "Air Terminal Units" and Section 230900 "Instrumentation and Control for HVAC."

D. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.
b. Monitoring supply fan start, stop, and operation.
c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
d. Monitoring occupied and unoccupied operations.
e. Monitoring constant and variable motor loads.
f. Monitoring variable-frequency drive operation.
g. Monitoring cooling load.
h. Monitoring economizer cycles.
i. Monitoring air-distribution static pressure and ventilation air volume.

2.11 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Coil guards of painted, galvanized-steel wire.

D. Hail guards of galvanized steel, painted to match casing.

2.12 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: 1 inch.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 24 inches.

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting:

1. Install RTUs on cast-in-place concrete equipment bases.
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.

d. Measure flue-gas temperature at furnace discharge.
e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.

29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 237413

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.
2. Gaskets: One set for each access door.
3. Fan Belts: One set for each air-handling unit fan.

1.7 QUALITY ASSURANCE

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. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
3. Trane; a business of American Standard companies.
4. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: Permanent, cleanable.
8. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Single-wall, galvanized-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1) Minimum Connection Size: NPS 1.

d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

B. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
c. Enclosure Type: Totally enclosed, fan cooled.
d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
f. Mount unit-mounted disconnect switches on exterior of unit.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Filters: Permanent, cleanable.
7. Condensate Drain Pans:

a. Fabricated with **one** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
2) Depth: A minimum of 1 inch deep.

b. Single-wall, galvanized-steel sheet.
c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1) Minimum Connection Size: NPS 1.

d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant Charge: R-410A.
    d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

F. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections.
2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 260100 – ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
   2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS

A. General
   1. Review of Contractors' submittals is for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Any action shown is subject to the Requirements of the Plans and Specifications. Contractor is responsible for quantities; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of work with that of all other trades and satisfactory performance of their work.
   2. The Contractor shall review each submittal in detail for compliance with the Requirements of the Contract Documents prior to submittal to the Architect. The Contractor shall "Ink Stamp" and sign each item of the submittal with a statement "CERTIFYING THE SUBMITTAL HAS BEEN REVIEWED BY THE CONTRACTOR AND COMPLIES WITH ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS".
   3. Where the Construction Documents indicate specific Manufacturer(s) for any given product, it shall be considered a substitution if the Contractor proposes to use any Manufacturer other than those specifically named. The Contractor shall clearly and specifically identify each individual proposed substitution or proposed deviation from the Requirements of the Contract Documents with a statement "THIS ITEM IS A SUBSTITUTION".

B. Material Lists and Shop Drawings:
   1. Submit Material List and Shop Drawings for approval within 14 days of award of Contract. Give name of Manufacturer and where applicable, brand name, type and/or catalog number of each item. Listing of more than one Manufacturer for any one item of equipment, or listing items "as specified", without both make and model or type designation, is not acceptable.
   2. Submittals which are intended to be reviewed as substitution or departure from the Contract Documents must be specifically noted as such or the Requirements of the Contract Documents will prevail regardless of the acceptance of the submittal.
   3. Shop Drawings shall include Dimensioned Plans, elevations, details, wiring diagrams and descriptive literature of components parts where applicable.

4. The Contractor shall verify dimensions of equipment and be satisfied as to fit and that they comply with all Code Requirements relating to clear working space about electrical equipment prior to submitting Shop Drawings for approval.
5. Shop Drawings shall include the Manufacturer's projected days for shipment from the factory of completed equipment, after the equipment is released for production by the Contractor. It shall be the responsibility of the Contractor to ensure that all material and equipment is ordered and installed in time to provide an orderly progression of the work, and to allow full occupancy and full operation of the facility at the scheduled completion date. The Contractor shall notify the Architect of any changes in delivery which would affect the project completion date.

C. The Contractor shall be responsible for incidental, direct and indirect costs resulting from the substitution of specified Contract Materials or work.

D. Maintenance and Operating Manuals
1. The Contractor shall provide Owner with typewritten maintenance and operating manuals for all electrical equipment, fire alarm equipment, sound system equipment, etc., to the District and instruct District's Personnel in correct operation of all equipment at completion of Project.
2. Maintenance and operating manuals shall be bound in three-ring, hard-cover, plastic binders and shall be delivered to the District with letter of transmittal, carbon copy to the Architect.

E. Portable or Detachable Parts: The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of Contract Work. These parts shall then be delivered to the District, or his Authorized Representative and an itemized receipt obtained, with copies of receipt sent to the Architect.

F. Record Drawings
1. Provide and maintain in good order at the job site a complete set of Electrical Contract prints. Changes to the Contract to be clearly recorded on this set of prints. No pay request by the Contractor will be granted without verification that the jobsite prints are up-to-date and current with the project construction. At the end of the project, the Contractor shall transfer all changes to one set of transparencies to be delivered unfolded to the Architect. Transparency Drawings shall be prepared in an organized and clearly legible fashion by persons skilled in drafting techniques.
2. The actual location and elevation of all buried lines, boxes, monuments, vaults, stub-outs and other provisions for future connections shall be referenced to the building lines or other clearly established base lines and to approved benchmarks. All measurements shall be witnessed by the Job Inspector who shall make his own record of the dimensions. Before the Inspector signs the Record Drawings, he shall check his own dimensions against those on the Drawings. If any necessary dimensions are omitted from the Record Drawings, the Contractor shall, at his own expense, do all excavation required to expose the buried work and to establish the correct locations.
3. The Contractor shall keep the "Record" prints up to date and current with all work performed.
4. A mandrel shall be pulled through each conduit upon completion of the duct bank. All mandrelling must be done in the presence of the Job Inspector.

1.3 GENERAL SUMMARY OF ELECTRICAL WORK

A. The Specifications and Drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

B. Refer to the Drawings and Shop Drawings of other trades for additional details which affect the proper installation of this work. Diagrams and symbols showing electrical connections are diagrammatic only. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.

C. Before submitting a bid, the Contractor shall familiarize himself with all features of the Building Drawings and Site Drawings which may affect the execution of the work. No extra payment will be allowed for failure to obtain this information.

D. If there are omissions or conflicts between the Drawings and Specifications, clarify these points with the Architect before submitting bid.

1.4 LOCATIONS OF EQUIPMENT

A. The Drawings indicate diagrammatically the desired locations or arrangements of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structure conditions encountered.

B. Where outlets are placed on a wall, locate symmetrically with respect to each other and other features or finishes on the wall.

C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes made without cost, providing the change is ordered before the conduit runs, etc. and work directly connected to same is installed and no extra materials are required.

D. The locations of existing utilities, building, equipment and conduit shown on the Drawings is approximate. Verify exact locations and routing of existing systems in the field. Include all costs in Contract price for adjustment required to accommodate existing conditions.

E. Coordinate and cooperate in every way with other trades in order to avoid interference and assure a satisfactory job.

1.5 QUALITY ASSURANCE

A. Work and materials in full accordance with the latest Rules and Regulations of the California Code of Regulations Title 24, Part 3 "California Electrical Codes", Title 8 "Division of Industrial Safety", the National Electrical Code, the National Life Safety Code, and other applicable Federal and State Laws and Regulations.

B. All material and equipment shall be new and shall be delivered to the site in unbroken pack-ages. All material and equipment shall be listed and labeled by Underwriters Laboratories or other recognized testing laboratories, where such listings are available. Comply with all installation Requirements and restrictions pertaining to such listings.

C. Work and material shown on the Drawings and in the Specifications are new and included in the Contract unless specifically indicated as existing or N.I.C. (not-in-contract).

D. Keep a copy of all applicable Codes available at the job site at all times while performing work under this section. Nothing in Plans or Specifications shall be construed to permit work not conforming to the most stringent of Codes.

1.6 CLEANING EQUIPMENT, MATERIALS, PREMISES

All parts of the equipment shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and all cracks and corners scraped out clean. Surfaces to be painted shall be carefully cleaned of grease and oil spots and left smooth, clean and in proper condition to receive paint finish.

1.7 JOB CONDITIONS - PROTECTION

Protect all work, materials, and equipment from damage from any cause whatever and provide adequate and proper storage facilities during the progress of the work. All electrical equipment shall be stored in a weathertight structure. Provide for the safety and good condition of all the work until final acceptance of the work by the District and replace all damaged or defective work, materials and equipment before requesting final acceptance.

1.8 CUTTING AND PATCHING

Perform cutting and patching of the construction work which may be required for the proper installation of the electrical work. Patching shall be of the same material, thickness, workmanship, and finish as existing and accurately match surrounding work to the satisfaction of the Architect. Cutting of structural members shall not be done without notifying the Architect and obtaining DSA approval.

1.9 IDENTIFICATION

A. Panelboards, terminal cabinets, circuit breakers, disconnect switches, starters, relays, time switches, contactors, pushbutton control stations, and other apparatus used for the operation or control of feeders, circuits, appliances, or equipment shall be properly identified by means of descriptive nameplates or tags permanently attached to the apparatus and wiring.

B. Nameplates shall be engraved laminated phenolic. Shop Drawings with dimensions and for-mat shall be submitted to the Architect before installation. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates shall not be used.

C. Tags shall be attached to feeder wiring in conduits at every point where runs are broken or terminated and shall include pull wires in empty conduits. Circuit, phase, and function shall be indicated. Branch circuits shall be tagged in panelboards and motor control centers. Tags may be made of pressure sensitive plastic or embossed, self-attached, stainless steel or brass ribbon.

1.10 POWER OUTAGES

A. All electrical services in all occupied facilities of the Campus are to remain operational during the entire contract period. Any interruption of the electrical power for the performance of this work shall be at the convenience of the District and performed only after consultation with the District. Work involving circuit outages shall be only at such a time and of such a duration as approved in writing. Work involving power outages for the work required to connect new equipment and disconnect existing equipment shall be performed at the convenience of the District.

B. Work involving system outages to the existing fire alarm, intrusion detection, telephone, computer, inter-communications, energy management, television, and/or clock systems shall be performed only after consultation with the District and shall be only at such a time and of such duration as approved in writing.

C. Provide overtime work; double shift work; nighttime work; Saturday, Sunday, and holiday work to meet outages schedule.

D. Any added costs to contractor due to necessity of complying with this Article shall be included in Contract Scope of Work.

E. When electrical work involving power disruptions to existing areas is initiated, the work shall proceed on a continuous basis without stopping until electric power is restored to the affected areas.

F. The Contractor shall request in writing to the District a minimum of 3-weeks in advance, for any proposed electrical outage.

1.11 ELECTRICAL WORK CLOSEOUT

A. Prepare the following items and submit to the Architect before final acceptance.
   1. Two copies of all test results and NFPA certificate indicated in the Project Manual.
   2. Copies of As-Built Record Drawings as required under the General Conditions, pertinent Division One Sections and Electrical General Provisions.
   3. Notify the Architect in writing when installation is complete and that a final inspection of this work can be performed. In the event any defect or deficiencies are found during this final inspection they shall be corrected to the satisfaction of the Architect before final acceptance can be issued.

END OF SECTION 260100
120123/1022037

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
   2. General provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit product data sheets for all outlet boxes and junction boxes.

PART 2 - PRODUCTS

2.1 OUTLET AND JUNCTION BOXES

A. Flush or concealed outlet and junction boxes: Pressed steel, hot-dip galvanized, knockout type with conduit entrances sized to match conduits. Provide boxes of proper code size for the number of wires or conduits passing through or terminating therein, but in no case shall box be less than 4 inches square by 2⅛-inches deep, unless specified elsewhere or noted otherwise on the Drawings. Provide extension rings on flush outlets to finish flush with finished surfaces.

B. Surface mounted outlet boxes: Cast iron type FS or FD, with threaded hubs as required. Provide plugs in all unused openings. Provide weatherproof gaskets for all exterior boxes.

2.2 SHEET STEEL PULL BOXES

A. Sizes as indicated on the Drawings and in no case of less size or material thickness than required by the Governing Code.
   1. General purpose sheet steel pullboxes: Install only in dry protected locations with removable screw covers. Manufacturer's standard baked enamel finish.
   2. Weatherproof sheet steel pullboxes: Fabricate of Code gauge, hot-dip galvanized steel with gasketed weathertight cover of same material. Manufacturer's standard baked exterior enamel finish.

PART 3 - EXECUTION

3.1 OUTLET AND JUNCTION BOXES

A. Accurately place boxes and securely fasten to structural members.

B. Boxes above accessible ceilings shall be attached to structural members. Where boxes are suspended, they shall be supported independently of conduit system by means of preformed steel channels. Boxes shall be supported independently of all piping, duct work, equipment, ceiling hanger wires and suspended ceiling grid system.

C. Where surface exposed conduit is connected to an outlet box, the outlet box shall be surface mounted.

D. Surface mounted outlets shall be attached to concrete or masonry walls by means of expansion shields.

E. Provide pullboxes, pulling ells, junction boxes, and condulets on metallic conduit runs whose total number of bends is 360 degrees or greater. Pulling and splicing enclosures shall be located in accessible ceiling spaces unless noted otherwise.

3.2 GROUNDING (ADDITIONAL REQUIREMENTS)

A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State of California and Local Authorities Having Jurisdiction.

B. Each pullbox or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C. The maximum resistance to ground shall not exceed 25 ohms.

END OF SECTION 260500
120123/1022037

SECTION 260530 - CONDUIT AND WIRE

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
   2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit product data sheets for all wire, conduit, fittings, and splicing materials.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid galvanized steel conduit: Hot-dip galvanized, zinc coated. Threads shall be galvanized after fabrication. Couplings, connectors, and fittings shall be threaded.

B. Electrical metallic tubing: Galvanized. Couplings and connectors, seamless steel construction and of the set screw or water-tight compression type with factory-applied permanently-attached insulated throat. Thomas & Betts Co. #5123 or #5031 Series or approved equal connectors and #5120 or #5030 Series or equal couplings.

C. Flexible conduit: Galvanized steel. Connector shall be screw-in type with factory-applied permanently-attached insulated throat. Bridgeport #520-DCI/521-DCI Series or equal by Efcor.

D. Liquid-tight flexible conduit: Sealtite Type U.A. with Appleton Series "ST" connectors.

2.2 WIRE AND CABLE

A. All wire and cable shall be copper, 600 volt, #12 AWG minimum unless indicated otherwise. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded. Type of insulation shall be THHN/THWN.

B. The following color code for branch circuits:

1. Neutral . . . White (Tape feeder neutrals with white tape near connections) where separate neutral conductors are indicated for branch circuits, color code the white neutral conductor with a colored stripe corresponding to the phase of the respective line conductors.
2. 120/208 Volt
   a. Ground Green
   b. Phase A Black
   c. Phase B Red
   d. Phase C Blue
3. Feeders identified as to phase or leg in each panelboard with printed identifying tape.
4. Fire Alarm conductors: See Section 284620

PART 3 - EXECUTION

3.1 GROUNDING

A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State of California and local authorities having jurisdiction.

B. The maximum resistance to ground shall not exceed 25 ohms.

C. Install ground wire in each conduit with line voltage conductors.

D. Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

3.2 CONDUIT

A. The sizes of the conduits for the various circuits shall be as indicated on the Drawings and as required by Code for the size and number of conductors to be pulled therein. Conduits to be concealed except as noted otherwise.

B. Rigid steel conduit shall be used where exposed on exterior of building.

C. Rigid galvanized steel conduit shall not be installed in direct contact with earth or sand.

D. Electrical metallic tubing up to and including 4 inch may be installed as permitted by codes except as otherwise referenced within these Specifications.

E. Flexible Steel Conduit:
   1. Flexible steel conduit may be used where concealed in walls or above ceilings.

F. Conduit Installation:
   1. Securely and rigidly support all conduits from building structure. Provide supports maximum of 10-feet on centers and within 3-feet of all bends, outlets, junction boxes, cabinets, panels and fittings. Conduits shall be supported independent of all piping, duct work, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure by means of approved pipe clamps or straps. The use of "plumbers' tape" is prohibited.
   2. Individual suspended conduits shall be supported by means of hanger rods and pipe clamps. Multiple suspended conduits shall be supported by means of trapeze type hangers and pipe

clamps. Conduits and conduit support systems shall be guyed to prevent swaying in any direction.

3. Individual conduits placed against brick, masonry or concrete walls or slabs shall be secured with pipe clamps and expansion shields. Individual conduits placed against dry wall or plaster construction shall be secured by means of pipe clamps and screws attached to studs or other structural members. The use of toggle bolts is prohibited. Provide preformed channel supports for all multiple conduits placed against walls or slabs.
4. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.
5. Conduit run exposed shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds or equal. Conduits run exposed shall be painted to match surrounding surfaces.
6. Individual conduits penetrating a fire-rated floor, wall, or ceiling shall be installed using an approved fire-stop sealant system equal to 3M Corporation FS-195/CP-25 or Hilti Inc. CS240 Series.

3.3 WIRE AND CABLE

A. Branch circuit and fixture joints for #10 AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and two wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by "Scotchlok".

B. Branch circuit joints of #8 AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, half-lapped and at least the thickness equivalent to the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.

C. Use UL listed pulling compound for installation of conductors in conduits.

D. Correspond each circuit to the branch number indicated on the panel schedule shown on the Drawings except where departures are approved by the Architect or the District's Inspectors.

E. All wiring, including low voltage, shall be installed in conduit.

F. Control wiring to conform to the Mechanical and Plumbing Specifications and Wiring Diagrams shown on the Drawings and the Manufacturer's Wiring Diagrams.

G. Neatly group and lace all wiring in panelboards, and terminal cabinets with plastic ties at 3-inches on centers. Tag all spare conductors.

END OF SECTION 260530
120123/1022037

SECTION 260923 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under Division 26.
   2. General Provisions and Requirements for electrical work.

1.2 EQUIPMENT QUALIFICATIONS

The Lighting Control System as described herein shall be as manufactured by Wattstopper, Lutron, Leviton or equal.

1.3 SYSTEM FUNCTIONS

A. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

B. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active communications.

C. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.

D. Digital Room Controller – Self-configuring, digitally addressable relay controllers for on/off control and 0–10-volt control dimming.

1.4 SUBMITTALS

A. Submit manufacturer’s data sheets for each component in the system.

B. Submit shop drawing including floor plan of the building showing all control devices and interconnecting wiring. Include wiring diagrams for field personnel.

PART 2 - PRODUCTS

2.1 DIGITAL CEILING MOUNTED OCCUPANCY SENSOR

A. Wall or Ceiling Mounted (to suit installation) Passive Infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration.
   2. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
   3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
   4. Device Status LEDs, which may be disabled for selected applications.

C. Multiple Occupancy Sensors may be installed in a room by simply connecting them to the free topology DLM Local Network. No additional configuration will be required.

2.2 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
   5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
   6. Programmable control functionality including:
      a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
      b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
   7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to Toggle, On only or Off only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

2.3 DIGITAL DAYLIGHTING SENSORS

A. Digital Daylighting Sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.

B. Digital Daylighting Sensors shall include the following features:
1. The sensor's internal photodiode shall only measure light waves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photo-optic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wave-lengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 footcandles (fc).
3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photo sensor shall provide a field-selectable dead-band, or a separation, between the "ON Set point" and the "OFF Set point" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photo sensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photo sensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photo sensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. One RJ-45 port for connection to DLM local network.
14. A choice of accessories to accommodate multiple mounting methods and building materials. The photo sensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photo sensors accommodate

mounting materials from 0-0.62-inch thickness. Extended tube photo sensors accommodate mounting materials from 0.62-inch – 1.25-inch thickness. Mounting brackets are compatible with J boxes and wall mounting. Photo sensor to be mounted on included bracket below skylight well.

15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. All digital parameter data programmed into a photo sensor shall be retained in non-volatile FLASH memory within the photo sensor itself. Memory shall have an expected life of no less than 10 years.

2.4 DIGITAL CONTROLLERS

A. Digital Controllers for lighting shall automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room controllers shall be provided to match the Room Lighting Requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications.

B. Controller shall have one relay for each switch shown on plans with a separate 0-10V dimming output for each relay

C. The following dimming attributes may be changed or selected using a wireless configuration tool:
   1. Establish preset level for each load from 0-100%
   2. Set high and low trim for each load

2.5 CONFIGURATION TOOLS

A. A Wireless Configuration Tool facilitates optional customization of DLM Local Networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION MEETING

A. A Factory Authorized Manufacturer's Representative shall provide the Electrical Contractor a functional overview of the lighting control system prior to installation. The Contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
   1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
   2. Review the Specifications for low voltage control wiring and termination.
   3. Discuss the functionality and configuration of all products, including sequences of operation, per Design Requirements.
   4. Discuss Requirements for integration with other trades.

3.2 CONTRACTOR INSTALLATION AND SERVICES

A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.

B. Contractor to install all room/area devices using Manufacturer's factory-tested CAT 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the Contractor is responsible for testing each field-terminated cable following installation and shall supply the Lighting Controls Manufacturer with test results. Contractor to install any room-to-room network devices using Manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM Segment Network Section of Specification. Low voltage wiring topology must comply with Manufacturer's Specifications. Contractor shall route network wiring as shown in Submittal Drawings as closely as possible, and shall document final wiring location, routing and topology on As-Built Drawings.

C. Install the Work of this Section in accordance with Manufacturer's printed instructions unless otherwise indicated. Before start-up, Contractor shall test all devices to ensure proper communication.

D. Calibrate all Sensor Time Delays and Sensitivity to guarantee proper detection of occupants and energy savings.
   1. Adjust time delay so that controlled area remains lighted while occupied.

E. Provide documentation on the configuration of the system.

F. Post start-up tuning – After 30 days from Occupancy Contractor shall adjust sensor time delays and sensitivities to meet the Owner's Requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.3 FACTORY SERVICES

A. Upon Completion of the installation, the Manufacturer's Factory Authorized Representative shall start up and verify a complete fully functional system.

B. The Electrical Contractor shall provide the Manufacturer with 3-weeks written notice of the system start up and adjustment date.

C. Upon Completion of the system start up, the Factory-Authorized Technician shall provide the proper training to the Owner's Personnel on the adjustment and maintenance of the system.

END OF SECTION 260923
120123/1022037

SECTION 260940 - LINE VOLTAGE OCCUPANCY MOTION SENSORS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
   2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit manufacturer's product data sheets for each sensor.

1.3 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

A. General
   1. All ultrasonic sensors shall comply with the State of California Safety and Health Requirements. Decibel levels for ultrasonic sensors shall comply with the following criteria and the State of California Energy Commission for ultrasonic emissions:
   2. The Contractor and Manufacturer shall certify in writing that all proposed and installed occupancy motion sensors comply with the Federal Environmental Protection Agency (EPA) and State of California Energy Commission criteria.
   3. Occupancy motion sensors shall be:
      a. UL listed and labeled.
      b. Certified for compliance with Federal-EPA and State of California Title-24 Energy Commission Requirements.

PART 2 - PRODUCTS

2.1 MOTION SENSORS

A. General
   1. Motion sensors and power supply shall be self-contained. The motion sensors shall be solid state low voltage devices designed specifically for energy conservation lighting control. Combined dual function ultrasonic and infrared motion sensing.
      a. Ultrasonic crystal controlled to within ±0.01% motion sensor technology.
      b. Passive infrared (PIR) motion sensor technology.
   2. Occupancy motion sensor shall also include available ambient light sensor, in addition to the motion sensor. The ambient light sensor shall prevent the occupancy motion sensor from automatically turning "on" the respective lighting when the ambient day lighting

intensity detected by photoelectric cell contained in the motion sensor exceeds a selected intensity. The ambient light sensor circuit shall not control the automatic off function. The ambient lighting intensity detection sensitivity shall be adjustable in the sensor, adjustment range not less than fifteen through 140-ambient day lighting footcandles.

3. Automatic-off: sensor shall automatically turn "off" lighting when there is no movement after the preset time delay interval. Lights shall remain "on" with movement. There shall be a "dead band" time period after the unit turns itself off (because of lack of motion) during which a new motion will automatically turn lights on without the manual switch having to be activated.
4. Automatic-on: Sensor shall automatically turn “on” lighting when movement is detected in the monitored space. Lights shall remain on with movement. An internal control shall provide a mechanism to bypass the automatic-on control feature and allow only automatic-off functions. Where manual on/off dimming lighting control switches are shown on the Drawings, in addition to the occupancy motion sensors in the same space, the manual controls shall override the automatic "on" control feature of the occupancy motion sensor. Override of the automatic "off" feature shall not be affected by the respective manual switches.
5. Motion detection sensitivity, time delays to turn "ON" after activation and time delays to turn "OFF, shall be adjustable to ensure there will be no nuisance on/off switching of the lights by the motion sensor while the room is occupied. Adjustable settings shall be tamper resistant, concealed behind an access protection cover.
6. Automatic self-adjusting Adaptive-Learning for time delay and sensitivity variable conditions in the monitored space.
7. Fail-to-on, the failure of a sensor shall cause the occupancy motion sensor load relay contacts to activate, so the occupancy motion sensor function is automatically by passed and lighting is turned-on.
8. All occupancy motion sensors shall be provided with an indicator light to display when motion is being detected and the unit is operating correctly.
9. Non-volatile internal memory shall store and maintain in memory all occupancy motion sensor settings during any electric power failure.
10. Where multiple occupancy motion sensors are installed with overlapping monitoring spaces, the sensors shall not cause false triggering or malfunctions to adjacent occupancy motion sensors.
11. Occupancy motion sensors shall incorporate mechanical vibration-damping. The vibration damping shall prevent normal building vibrations from causing “false” sensor operation.
12. As manufactured by WattStopper; or Leviton; or equal.

B. Area Control Coverage
   1. Space coverage of motion sensor transponder shall remain constant after sensitivity control has been set. No automatic reduction/increase in coverage nor sensitivity shall occur when air motion caused by air conditioning or heating fans are in operation nor when the occupancy motion sensor has turned off lighting due to not detecting any motion.
   2. Occupancy motion sensors shall be a wall switch mounted unit.
      a. Wall switch occupancy motion sensors shall be a minimum load capacity of 500 watts 120V; 1000 watts 277V, but in no case shall the load rating be less than the lighting loads shown on the Drawings.
      b. Refer to Drawings for sensor locations and switching

rating control interface should comply with Lighting Control System Requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and set sensors per manufacturer's installation instructions.

3.2 TESTS

A. Demonstrate proper operation of the sensors in the presence of the Project Inspector.

END OF SECTION 260940
120123/1022037

SECTION 26 24 15 – SWITCHBOARDS, PANELBOARDS AND TERMINAL CABINETS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide Manufacturers catalog data for panels, cabinets, and circuit breakers.

B. Provide Shop Drawing showing panel circuit arrangements, size, voltage, ampacity, over-current protective devices, etc.

C. Provide nameplate engraving schedule.

D. Short Circuit, Coordination and Arc-Flash

1. Perform and submit engineered settings for each equipment location, fuse, and adjust-able circuit breaker device, showing the correct time and settings to provide the selective coordination within the limits of the specified equipment, per the latest applicable Standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.
2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
3. The goal is to minimize an unexpected but necessary electrical system outage and personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract equipment. Shall comply with, but not limited to:

    a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
    b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
    c. IEEE-1584, Guide to Performing Arc-Flash Hazard Study.
    d. CEC

4. Electrical equipment including switchgear, switchboards, electrical panels, and control panels, transformers, disconnects, etc., shall each be labeled by the Manufacturer with “Electrical-Arc-Flash” warning signs. The signs shall explain a hazard to personnel may exist if the equipment is worked on while energized or operated by personnel, to wear the correct protective equipment/ clothing (PPE) when working “Live” or operating “Live” equipment and circuits.

1.3 SEISMIC EARTHQUAKE AND WIND LOADING WITHSTAND, TESTING AND CERTIFICATION (ADDITIONAL REQUIREMENTS)

A. General

1. The complete panels and terminal cabinets assemblies; including circuit protection devices, meter, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured, and tested.

a. Wind loading all outdoor equipment locations.
b. Earthquake Seismic Requirements of the CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.

2. Shall withstand, survive, and maintain continuous non-interrupted energized operation during seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.

PART 2 - PRODUCTS

2.1 MAIN SWITCHBOARD

A. Switchboard shall be floor-mounted, dead-front, dead-rear type, front and rear aligned, self-supporting, consisting of one or more vertical sections with bussing, circuit protective devices, instrumentation, auxiliary devices and control wiring as indicated on the Drawings and as specified herein.

1. Shall be utility and service entrance rated and approved.
2. Voltage, amp, and interrupting ratings as indicated on drawings
3. Switchboards shall employ mounting configuration for circuit protective devices as follows:
   a. Group-mount, fixed position, non-drawout with front access only, shall not require rear access. Typical for all circuit protective devices or as indicated on Drawings.
4. Switchboards shall employ molded case type circuit breaker types and circuit protection devices
5. Surge Protection Device – SPD

a. Provide an SPD in each switchboard, with 40-amp 3-pole subfeed circuit breaker.
b. SPD shall be mounted inside main switchboard and shall be equal to General Electric “Tranquell” ME A series, 65Ka/mode, 130Ka/phase.

B. Switchboard shall be designed, built, and tested in accordance with applicable portion of the latest editions of NEMA PB-2, Underwriters Laboratories No. UL-891 and the National Electrical Code. Rated for service-entrance operation.

C. Switchboard Sections Configuration

1. Floor standing self-supporting, of the universal frame type using die-formed, 12-gauge steel members bolted and welded together.
2. Provide removable side and rear plates with formed edges all around.
3. Provide removable steel cover plates for all usable device spaces. Provide lifting means and provisions for moving by means of rollers or skids to installation location.
4. Bolt individual Sections together to form a single rigid switchboard assembly.
5. Provide full height, hinged, vertical wireway metal covers, on each vertical wireway, of each distribution Section of the switchboard.

D. Switchboard shall include, but not be limited to, the following:

1. Underground pull Section as required by the serving utility incoming service.
2. Metering facilities as required by the serving utility.
3. Current transformer space.
4. Main disconnects devices.
5. Distribution and feeder circuit protective devices.
6. Bussing, incoming utility compliant and outgoing distribution.
7. SPD device.

E. Enclosure shall be NEMA 3R, non-walk-in, tamper resistant construction. Provide full height hinged doors with provisions for padlocking the doors in the closed position.

F. Provide a nominal 300-watt sealed, resistance type, anti-condensation heater in each equipment Section. Heaters shall be controlled automatically by Thermostats and Humidistats. A circuit breaker shall be provided to supply switchboard buss voltage to the heaters, all prewired by the Manufacturer to fused terminals.

2.2 DISTRIBUTION PANELS

A. Shall have voltage, amp, and interrupting ratings as indicated on drawings, with group-mount molded case circuit breakers as shown on drawings, hinged lockable doors, index cardholders, and proper bussing.

1. Panelboards shall comply with the latest versions:

a. NEMA – PB1.
b. UL – 50 and 67.
c. CEC
d. ASTM-B187.

B. Housing and Painting, Panels and Terminal Cabinets

1. Shall be finished with one coat of rust inhibitor zinc chromate and coat of primer sealer after a thorough cleaning.
2. Finish color paint shall match color of new building as selected by Owner's Representative.
3. Shall be fabricated of sheet steel of the following minimum gauges.

a. Full height standard hinged, locking door. Trim #12-gauge steel; enclosure - Code gauge steel.
b. Panels installed in indoor dedicated electrical equipment rooms and dedicated electrical equipment closets, omit full height hinged locking panel door. Dead front cover behind omitted panel door shall remain.

4. NEMA-3R Metal Housing, tamper resistant, for outdoor locations. Provide a nominal 300-watt sealed, resistance type, anti-condensation heater in panel. Heaters shall be controlled automatically by Thermostats and Humidistats. A circuit breaker shall be provided to supply switchboard buss voltage to the heaters, all prewired by the Manufacturer to fused terminals.
5. Furnish all panels and terminal cabinets with hasps for padlocks furnished by District.
6. Fasten the trim to panel and terminal cabinets by means of concealed, bolted, or screwed fasteners accessible only when the door is open.

C. Distribution Panels as manufactured by:

1. Eaton: "Power-R-Line 3 or 4" Series
2. Siemens: "P4/P5" Series
3. Equal by Square D.

D. Top and bottom gutter space shall not be less than 6-inches high. Provide 6-inches additional gutter space in all panels where double lugs are required, or where cable ampere size exceeds bus ampere size.

E. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements)

1. The complete panel/panelboard assembly; including circuit protection devices, housings/ enclosures, accessories, supports/anchors etc., shall be designed, manufactured, and tested for wind loading and earthquake seismic install location withstand.
2. Shall withstand, survive, and maintain continuous non-interrupted energized operation (running) during the seismic event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation.

2.3 SHORT CIRCUIT RATING

Circuit protective devices and bussing as indicated on the Drawings.

2.4 CIRCUIT BREAKERS, CIRCUIT PROTECTION DEVICES

A. General

1. NEMA-AB1 and AB3, comply with latest revision.
2. UL-1087, UL-489 and IEC-60.947.2 rated devices, comply with latest revision.
3. 5Hz AC closing and 3Hz AC trip and clear.
4. Circuit breakers shall be Molded Case Circuit Breakers type.
5. All circuit breakers larger than 125A trip shall employ sensors and solid state digital electronic automatic trip system. Short-time and long-time time/current curve shaping field adjustable functions and adjustable instantaneous trip.

B. Manufacturer

1. Circuit breakers as manufactured by the same manufacturer as the panel or switchboard in which they are installed.

C. Configuration

1. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings, phase connections, and numbers correspond to the numbering on the Single Line Diagram.
2. Panelboard circuit protection devices shall be bolt on type for connection to panel bus. Removable and installable without disturbing adjacent devices.
3. Provide conductor wire terminations (lugs) on each circuit protection device for incoming main feeder, branch circuits and outgoing feeder circuits. Dual rated copper/aluminum and compatible with the respective conductor size, type, and quantity.
4. Where 2-pole or 3-pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

D. Lock-Off and Lock-On

1. All circuit breakers shall be pad-lockable in the "off" position.
2. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall also be furnished with lockout clips, mounted in the “on” position. The breakers shall be able to trip automatically with lockout clips in place.
3. Provide lock-on clips on branch circuit breakers supplying fire alarm equipment and fire alarm panels. Provide identification of the dedicated "fire alarm" circuit function and operation. Color-code the circuit breakers to comply with AHJ Requirements.

4. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval. Other means of attachment shall not be accepted without prior written approval of the Owner's Representative.

2.4 PANEL BUSSING

A. Bus Material

1. Bussing shall be rectangular cross section tin-plated copper or alternately silver or tin-plated aluminum.
2. Bussing shall be non-tapped, full length of the enclosure.

B. Ground Bus

1. Each panel shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C. Provisions

1. Provide space and all hardware and bus mounting attachments for future devices as indicated on the Drawings.

switchboard.

2.5 TERMINAL AND AUXILIARY CABINETS

A. Cabinets

1. Fabricated of code gauge sheet steel for flush mounting (except where noted as surface) of size indicated on the Drawings, and complete with hinged pad-lockable doors, provide the quantity of two-way Feed through conductor terminals required for termination of all conductors.
2. Cabinets shall be finished with one coat of zinc chromate and one coat of primer sealer after a thorough cleaning. Where exposed to public view (e.g., corridors, covered pass-ages, offices, etc.) finish color paint to match surrounding and Manufacturer’s standard gray color in switchboard, janitors, heater and storage rooms.

B. Cabinet Dimensions shall be as indicated on the Drawings.

C. Terminals

1. Non-digital analog circuits; line and low voltage modular signal systems, 15-amp dual row with isolation barriers, screw-down terminals insulated strips, heavy duty.

   a. As manufactured by: Molex, or ITT-Cannon, or General Electric.

2. Digital circuits; low voltage signal systems, ANSI/EIA/TIA Category-6, 110-Block, or 66-Block gas-tight punch down style, heavy duty.

   a. As manufactured by: Leviton, Ortronics, or AMP.

D. Identification (Additional Requirements)

1. Provide engraved nameplate on each cabinet indicating its designation and system (i.e., “Intrusion Detection System”).

PART 3 - EXECUTION

3.1 MOUNTING

A. Surface mounted panels and terminal cabinets shall be secured to walls by means of preformed galvanized steel channels securely fastened to at least two studs or structural members.

B. Panels and terminal cabinets shall be installed to ensure the top circuit protective device (including top compartment control devices) are not more than 6-feet-6-inches above finish floor in front of the panel and the bottom device is a minimum of 12-inches above the floor.

3.2 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Manufacturer shall stencil the panel/cabinet number identification on the inside of door to correspond with the designation on the Drawings.

B. Identification plates and numbers shall be attached with screws or twist lock fasteners. Adhesive attachment of any kind shall not be used.

END OF SECTION 26 24 15

SECTION 263300 - BATTERY ENERGY STORAGE SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
   2. General Provisions and Requirements for electrical work.
   3. Provide a complete and operable grid connected energy storage system. The system shall include outdoor rated, self-contained, pad mounted equipment and shall be grid-connected to the load side of the utility co. meter. The systems shall provide the minimum kilowatt and kilowatt-hour ratings indicated on the plans. The system shall include all materials and labor, engineering, documentation, and commissioning services required for the system to be complete and operable.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. General
   1. Submit Manufacturer's product data sheets and descriptive literature for all system component parts including but not limited to batteries, controllers, inverters, enclosures.
   2. Submit detailed Shop Drawings including Dimensioned Plans, elevations, details, single line diagrams and point to point (terminal end-to-end terminal) wiring diagrams.
   3. Diagrams shall be specific for this Project and directly applicable thereto. Generic Drawings and diagrams are not acceptable.
   4. Block Diagram – Show interconnections between components specified in this Section and devices furnished under the other Sections. Indicate data communication paths and power flow, data buses, data gateways, and other devices to be used. Describe characteristics of the system.
   5. Submit the following system characteristics:
      a. Usable energy storage capacity (kwh)
      b. Rated power (kw ac)
      c. AC: AC efficiency (including auxiliary loads)
      d. Cycle life
      e. Annual degradation factor
      f. Ambient temperature control system
      g. Fire protection/suppression system description as required by Code.
      h. Equipment Manufacturers and product names
      i. Battery Management System Provider
   6. Software and Firmware Operational Documentation:
      a. Software operating and upgrade manuals.
      b. Program Software Backup: On a magnetic media, optical compact disc (CD or DVD), complete with data files.

c. Device address list.
d. Printout of software application and graphic screens.
e. Descriptions of software program control and monitoring operations.

B. Utility Notification and Submittals
1. The Contractor shall notify in writing the local Electric Utility Company Representative at the start of the Construction Contract about the grid-tied energy storage system within 60 days after award of Construction Contract. The Contractor shall request, in writing, the Utility Company interconnection forms, applications and paperwork from the Utility Representative.
2. The Contractor shall complete the Utility applications, paperwork and supply the Utility requested Equipment Shop Drawing information and documentation in the name of the District, to the Utility Company Representative.
3. All Utility submitted documents shall also be transmitted to the District's Representative, at the time of the submissions to the Utility Representative.

C. Extended Warranty (Additional Requirements).
1. Manufacturer's extended warranties, beyond 1-year after acceptance of building occupancy permit or contract notice completion date, for material, labor, workmanship, and performance:
a. Battery pack performance warranty for at least 10 years after the date of successful completion of commissioning. Battery pack shall retain at least 70% of nominal energy capacity for the earlier of 10 years after commissioning.
2. Power conversion system warranty of at least 10 years from successful completion of the commissioning.
3. Full turnkey system warranty for 1 year from successful completion of the commissioning. Contractor shall respond within 3 days if maintenance is required.

D. Certifications, rebates, and subsidies:
1. The Contractor shall notify each Agency Representatives providing certificates of compliance, monetary rebates and monetary subsidies for renewable energy and photo-voltaic system installation, in writing, at the start of the construction project about the system. The Contractor shall request, in writing, each Agency's application forms and paperwork to establish eligibility for the Contract system within 60 days after Award of Construction Contract.
2. The Contractor shall complete the applications and paperwork and submit to each Agency the supporting documentation requested by each Agency. Submitted information shall also be transmitted to the District's Representative at the same time.
3. Monetary rebates and subsidies shall accrue to the District, not to the Contractor.

1.3 MANUALS AND DOCUMENTATION (ADDITIONAL REQUIREMENTS)

A. Hardware, Software and Firmware Operational Documentation
1. Hardware and software operating manuals.
2. Program Software Backup: On a magnetic media or optical compact disc (CD) or digital video disc (DVD) complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Operation of adjustable controls.
6. Testing and adjusting features.

B. Instructions (Additional Requirements)
   1. Provide instructions in the operation and maintenance of the PV system to the District's Personnel.

1.4 QUALITY ASSURANCE (ADDITIONAL REQUIREMENTS)

A. General
   1. The Contractor shall engage trained Personnel and Sub-Contractors to perform installation final start-up, commissioning, configuration, and system testing.
   2. Qualified Manufacturer-Authorized Technicians shall provide a complete inspection prior to energizing of the system, to assure that all passive and active system components have been provided and installed in accordance with the Contract Documents and Manufacturer's recommendations.

B. The equipment specified herein is based on the products of Sungrow Power Supply Co. Ltd. "Power Stack" series. Equal products by other manufacturers meeting this Specification will be approved.

C. Standards and Approvals
   1. The BESS components shall be tested and approved by Underwriters' Laboratories (UL) or another Nationally Recognized Testing Facility.
   2. Batteries, Enclosures, Inverters, and other Balance of System Components must be Certified to comply with the latest Version of the following Requirements:
      a. UL 1642 "Standard for Lithium Batteries"
      b. UL 1973 "Batteries for use in Light Electric Rail Applications and Stationary Applications"
      c. UL 9540 "Energy Storage Systems and Equipment"
      d. UL 9540A "Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems"
      e. Institute of Electrical and Electronics Engineers (IEEE) 1547
      f. UL 1741, "Standard for Static Inverters and Charge, Converters, Controllers and Interconnection System Equipment for use with Distributed Energy Resources"
      g. UL 62109-1 "Safety of Power Converters for use in Photovoltaic Power Systems – Part 1: General Requirements"
      h. UN 38.3 "Certification for Lithium Batteries" (transportation)
      i. American National Standards Institute (ANSI) C12.1 (electricity metering)
      j. IEEE 2030.2, guide for the interoperability of energy storage systems integrated with the electric power infrastructure

D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a Testing Agency acceptable to authorities having jurisdiction and marked for intended use.

E. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

F. Comply with NFPA 70 and CEC-T24.

G. Comply with State and Local Energy and Electrical Codes.

H. Control wiring shall be in accordance with CEC Electrical Codes.

I. Ethernet LAN protocols shall conform to and be fully compatible with all IEEE and EIA-568B, for 10/100 Base T, TCP/IP fast Ethernet.

J. BACnet shall conform with the latest prevailing ASHRAE Standard.

K. Equipment and components shall be Certified for compliance with Federal-EPA and State of California Title-24 Energy Commission.

L. California and National Electrical Code CEC-690.

M. California State Fire Marshal Guidelines.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. The system shall provide grid electricity usage and demand control/peak shaving to limit demand (kw) to programmed setting.

B. Time of use charge reduction: integrate the system to discharge during on-peak hours in accordance with the site's rate tariff.

C. A battery management system shall be provided to control the charging and discharging of the equipment. System shall be field programmable by connecting with a laptop and viewing/ editing on a locally hosted web browser.

D. System shall maintain a round-trip efficiency greater than 70% ac-in to ac-out (confirmable by operation over a single round-trip cycle from 0% state of charge to 100%, and back to 0% at standard conditions specified by the manufacturer), including thermal losses and auxiliary loads, over 10 years.

E. Provide all components to operate the BESS within acceptable operating temperatures. Provide any thermal management systems and operating strategies required to maintain the BESS and inverter temperatures within Manufacturer's recommendations at all times.

F. All materials furnished for the project shall have an expected service life of at least 10 years.

2.2 DATA ACQUISITION AND MONITORING

A. Provide a turnkey data acquisition and display system that allows the Owner to monitor, diagnose, and track the charging, discharging, and operating data of the BESS. Minimum Requirement is the provision of a web-based monitoring and tracking system. Provide internet connection to the BESS from Owner internet. Monitoring and tracking systems shall include a historical database and real time data portal capturing the data in 15-minute intervals. The data shall, at a minimum, comprise the following information and frequency of collection:
   1. Date, time.
   2. Apparent power (KVA)/phase, real power (kw) and volts on each phase; recorded in 15-minute intervals.
   3. BESS state of charge

4. Ambient temperature, hourly average at hourly intervals, either from on-site measurements or a reliable climate data service.
5. The web-based monitoring system shall report actual system performance and an estimate of expected performance.

B. The system shall allow Owner to interact with BMS to update settings and modify setpoints.

2.3 GROUNDING

A suitable equipment grounding system shall be provided and installed for the BESS. The grounding system shall provide personnel protection for step and touch potential in accordance with IEEE 80. The system also shall be adequate for the detection and clearing of ground faults within the BESS. The system should be grounded in all anticipated operating modes (e.g., grid-tied and islanded).

2.4 MARKINGS (LABELING)

A. Electrical equipment and components used in BESS shall have markings that identify the Manufacturer, size, type, ratings, hazard warnings, and other Specifications.

B. Labelling shall include posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.

C. All disconnects shall be clearly labelled, indicating operating system voltage, current, and system rating.

D. Equipment markings shall be permanent and able to withstand the environmental conditions in which the equipment is installed (e.g., “UV rated” for outdoor labels, or on an embossed steel placard, designed for outdoor use and fastened with adhesive and rivets).

E. Markings shall be visible or easily accessible during and after installation. The Contractor shall be responsible for all field-applied markings as required by Local, State, and Federal Codes.

2.5 OPERATIONS AND MAINTENANCE

A. Conduct Annual O&M and continuous monitoring to verify that the BESS is performing as intended per the proposed battery storage strategy and Manufacturer recommendations and submit an Annual Report to Owner. The Report shall include:
1. Use case performance.
2. Battery outages with root cause summary and start and end time periods.
3. Summary of all O&M operations; repair and replacements
4. Summary of safety incidents, causes and resolutions
5. Perform all required maintenance to the BESS and BMS to ensure that the monthly demand reduction is provided.
6. Provide O&M training and support manuals to Agency Personnel.
7. Perform updates to the BMs dispatch strategy if required due to rate tariff or major site load profile changes.
8. Ensure that all system firmware is up to date and meets Cybersecurity Requirements.

2.6 SAFETY

A. The BESS shall have a data acquisition/monitoring/alarm system, including.
   1. Full monitoring of electrical power and related operational data, including voltage, current, and system temperature.
   2. Visual and audible alarm if potential safety hazard exists.
   3. Notification of when preventive maintenance is needed.
   4. System level alerts shall be provided by the Manufacturer over customer interface.

B. The BESS shall contain protective relays, circuit breakers, or fuses which self-protect the BESS in the case of internal electrical faults. Set and adjust circuit protection devices according to a short circuit and coordination study.

C. A detailed plan surrounding battery cell thermal runaway detection and mitigation systems in the BESS will be included in the submittal process.

D. A visible disconnect will be installed that isolates BESS in accordance with Utility Interconnection Requirements.

E. All electrical equipment, enclosures, disconnects, and overcurrent devices shall be clearly marked and identified. Markings shall reference the same designations called out in the final Design Drawings.

F. Develop posted instructions for tasks that Owner may need to perform, such as system shutdown during an emergency.

PART 3 - EXECUTION

3.1 GENERAL

A. Conduit and Wire (Additional Requirements)
   1. Provide conduit and wire for AC and DC electrical power circuits.
   2. Provide conduit and wire for low voltage control and monitoring circuits.
   3. Conduits with circuits, exposed on the roof, circuit conductors shall be rated for operation in minus 40 degrees to plus 90 degrees centigrade ambient temperatures.
   4. All circuits are installed in conduits.

B. Circuit Protection Devices (Additional Requirements)
   1. Circuit breakers, fuses and disconnect/safety switches shall be rated and labeled to be energized from sources on both the line and load sides.

3.2 TESTING AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

A. A Commissioning Plan shall be provided by Contractor prior to proceeding with inspection and commissioning:
   1. After Agency’s utility provides permission (interim for testing) to operate in parallel with the grid, the Contractor shall complete commissioning in accordance with agency safety and commissioning plans, its own quality-control plan, Manufacturer's recommendations,

and Franchise Utility Interconnection Requirements. The Contractor shall document all performance measurements.

2. The Contractor shall perform all work required for testing, start-up, and commissioning.
3. The BESS shall be commissioned per the Electric Power Resource Institute (EPRI) "ESIC Energy Storage Commissioning Guide", or by a similar standard.
4. The system shall be started-up and tested in accordance with the regulations of the applicable interconnection standards. All possible anticipated modes of operation shall be tested (grid-tied, islanded).
5. The Contractor shall request and coordinate system acceptance testing with the utility and Owner for acceptance and certification of the BESS and permission to operate, after commissioning and final inspections are complete.
6. Commissioning shall include the data acquisition system and enclosure thermal conditioning system.

3.3 ANCHORAGE

Anchor equipment cabinets to concrete pads as detailed on the Drawings.

END OF SECTION 263300
032724/1022038

SECTION 26 50 00 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
   2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A Provide complete Manufacturer’s catalog data information for each light fixture (luminaire), driver, lamp, materials, auxiliary equipment/devices, finishes.

1.3 QUALITY ASSURANCE (ADDITIONAL REQUIREMENTS)

A. Work and Materials shall be in full accordance with the latest edition of the publications below. If a conflict occurs between the following publications and any other part of the Contract Documents, the Requirements describing the more restrictive provisions shall become the applicable Contract definition:
   1. UL – Underwriters' Laboratory:
      a. UL – 8750 and 1598C: Light Emitting Diode – LED Equipment for use in Lighting Products and Replacements
   2. NEMA – National Electrical Manufactures Association:
      a. NEMA – LE4: Recessed Luminaries Ceiling Compatibility
      b. NEMA – LSD #44, #45, #49 and #51: SSL – Solid State Lighting
   3. United States Federal Government:
      a. FCC – Part 18: EMI and RFI emissions limitations.
      b. EPA: Energy conservation publications and waste disposal regulations.
   4. ETL and C.B.M. Certified and Approved.
   5. Electrical installation standards, National Electrical Contractors' Association:
      a. NEIS/NECA/IESNA – 500: Recommended Practice for installing Indoor Commercial Lighting Systems.
      b. NEIS/NECA/IESNA – 501: Recommended Practice for installing Exterior Lighting Systems
      c. NEIS/NECA/IESNA – 502: Recommended Practice for installing Industrial Lighting Systems.
   6. Illuminating Engineering Society – IES (IESNA):
      a. IES – LM41: Photometric and Reporting.
      b. IES – 587: Surge Protection.

c. IES – LM79: Solid State Lighting (SSL) Testing and Measurement.
d. IES – LM80: Testing for Lifetime of LED.

7. ANSI-American National Standards Institute:
   a. ANSI – C81
   b. ANSI – C82
   c. ANSI – C62.41: Transient Withstand
   d. ANSI – C78: Lamps
8. State California Code of Regulations - Title-24: Energy Code

PART 2 - PRODUCTS

2.1 GENERAL

A. Complete Fixture
   1. Provide light fixtures complete including lamps, drivers, housings, ceiling and wall trim "rings" for each ceiling type, mounting and adapter support brackets, diffusers/ lenses and outlet boxes.

B. Specific Fixture Requirements and Fixture Schedule Information
   1. The catalog numbers included in the description of the various types of lighting fixtures shall be considered to establish the type or class of the fixture with a particular Manufacturer only. The fixture length, lumen outputs, component materials, accessories, mounting type, ceiling, wall and install adapters, operation voltage, and all other components required to fulfill the total description of the fixture based on all drawing information, branch circuits, voltages, Specification information, and shall be included in the Contract Requirements regardless of whether or not the catalog number specifically includes these components.
   2. Lighting fixtures shall be the types as indicated in fixture schedule on the Drawings and as described in the Specifications.
   3. All fixtures of the same fixture type shall be the same Manufacturer and of identical finish and appearance, unless indicated otherwise on Drawings.

2.2 LIGHT FIXTURES (LUMINARIES)

A. General
   1. Lighting fixtures shall have all parts, drivers, support attachments, trim flanges and fittings necessary to complete and properly install the fixture at the indicated installation locations. All fixtures shall be provided with lamps of size and type specified.
   2. Ceiling and/or wall surface mounted lighting fixtures shall not have any exposed chase nipples or conduit knockouts visible to view within fixture housing. Lighting fixtures mounted in continuous rows shall have chase nipples or conduit knockouts between lighting fixture housing but shall not have visible chase nipples/conduit knockouts on the visible ends of the continuous row of lighting fixtures.
   3. Recessed fixtures with attached junction box shall be provided with a junction box permanently attached to the plaster ring so that the junction box is accessible through the fixture opening when the fixture is removed. Connection between fixture and pullbox shall be flexible metal conduit with not less than 16 AWG "AF" or "CF" type fixture rated copper wires, high temperature wire insulation for not less than 600 volts AC. The flexible conduit

shall be sufficient length, so that when the fixture is removed, the pull-box is readily accessible.

4. Recessed fixtures shall be Underwriters' Laboratory approved for recessed installation with plaster frame and attached pull box. Lamp enclosure, reflectors and finish wiring shall not be installed until plastering is completed. Exposed finish trim shall not be installed until finish painting of the adjacent surface is completed.
5. The fixture shall bear Underwriters' Laboratory label of approval for the wattage and installation indicated.

B. Lens and Diffusers
1. Acrylic plastic or Plexiglas for the light fixture diffusers or fixtures lenses shall be 100% virgin material.
2. Diffusers shall be formed from cast sheet by a vacuum and/or pressure technique.
3. Lighting fixtures containing lamps with dichroic reflectors and light fixtures with non-dichroic lens/diffuser shall be rated for high temperature lamp operations resulting from lamp heat redirected (reflected) back into the fixture.

2.3 SOLID STATE LIGHTING (SSL), LIGHT EMITTING DIODES (LED) LAMPS, POWER SUPPLIES, AND LIGHT FIXTURES (ADDITIONAL REQUIREMENTS)

A. General
1. Shall comply with the US-DOE Energy Star Program for SSL-LED. Submit documentation with Shop Drawings.
2. Shall comply with the latest revision IESNA LM-79 and LM-80. Submit documentation with Shop Drawings.
3. SSL chromaticity shall comply with latest revision NEMA and ANSI – C78.377. Submit documentation with Shop Drawings.

B. LED Lamps
1. Lamp lumen output and overall efficiency shall be based on the LED lamps installed in specified fixture and ambient operating temperature.
2. Lamp Color Rendition Index (CRI) shall equal or exceed CRI – 80, unless noted otherwise on Drawings.

C. LED Power Supply (driver)
1. Combination of power supply and SSL – lamp shall be tested and certified by respective Manufacturers for performance and proper operation.
2. Provide dimming type driver where indicated on Drawings. Driver and dimming equipment shall be tested and certified by respective Manufactures for performance and proper operation.

PART 3 - EXECUTION

3.1 LIGHT FIXTURE INSTALLATION

A. General
1. The Contractor shall verify actual ceiling and wall construction types as defined on the Architectural Drawings and furnish all lighting fixtures with the correct mounting devices, trim rings, brackets whether or not such variations are indicated by fixture catalog number. The Contractor shall verify depth of all recessed lighting fixtures with Architectural

Drawings prior to ordering fixtures. Any discrepancies that would cause recessed lighting fixtures not to fit into ceiling shall be reported to the Owner's Representative prior to release of order to the supplier of the fixtures.

2. Fixtures shall be ordered and furnished to operate correctly on the branch circuit voltage connected to the respective fixture as shown on the Site Plan and Floor Plan Electrical Drawings. The voltages shown on the fixture schedule are for generic fixture information only.
3. Install and connect lighting fixtures to the circuits and control sequences indicated on the Drawings and to comply with respective Manufacturer's instructions/recommendations.

B. Fixture Supports

1. The support wires for light fixture support shall be 12-gauge steel (minimum). The wires including their building and light fixture attachments shall provide support capacity of not less than four times the weight of the light fixture assembly. Provide additional light fixture support wires and building anchors to meet these Requirements, as part of the Contract. The support wires shall be anchored to the building structural elements above the ceiling.
2. Fixtures shall be plumb and vertical. Where obstructions arise restricting 45-degrees free-swing of fixtures, the fixtures shall be "guy" wired to prevent fixtures from striking obstructions. The Owner's Representative shall approve method of guying. Swinging fixtures shall have an additional safety hanger cable attached to the structure and the fixture at each support, with the capacity of supporting four times the vertical weight of the light fixture assembly.
3. Suspended fixtures shall be supported independently of the fixture outlet box. Provide "aircraft" (minimum 12 gauge) steel hanger cable for suspended fixtures route cable concealed or in pendant where possible. Each cable attachments shall support four times the weight of the fixture assembly. Securely attach the cable to the building structure.
4. Surface mounted fixtures installed on drywall or plaster ceilings shall be supported from outlet box. Also provide Unistrut or equal structural support above ceiling along the length of the fixture, attached to structure, and bolt fixture to the Unistrut through the ceiling at each end of fixture.

3.2 LENS AND DIFFUSERS

A. Lens, diffusers, internal reflectors shall be completely cleaned of all dust, dirt and fingerprints after the installation of the light fixtures and lamps, and after all trades have completed work and prior to occupancy of the facility by the Owner.

END OF SECTION 26 50 00

SECTION 265200 – EMERGENCY LIGHTING INVERTER

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
   2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Manufacturer product data, dimensional data, ambient environmental data and derating factors, electrical performance data.

B. Submit extended warranty statements for batteries.

1.3 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

A. General
   1. The equipment shall be listed, labeled, and approved for the application show in the Contract Documents, as a battery stored energy, emergency lighting electrical power inverter, complying with the most recent version of the following applicable Standards.
   2. The following Standards shall become Requirements of Contract Document and are included in the Contract Documents.

B. Underwriters Laboratory - UL
   1. UL – 924 and 924A Standard for Emergency Lighting and Power Equipment.
   2. UL – 1778 Standard for Uninterruptible Power Supply Equipment.

C. National Fire Protection Agency - NFPA
   1. NFPA – 111 Stored Electrical Energy and Standby Power systems.
   2. NFPA –70 Article 700 Emergency Systems. (NEC) Article 480 Storage Batteries.

D. Federal Communications Commission - FCC
   1. FCC - Class A RFI emission limits.

E. American National Standards Institute – ANSI
   1. ANSI – C62.41 Both Category-A and Category-B and C62.45 Voltage Withstand.

F. Institute of Electrical and Electronic Engineers-IEEE
   1. IEEE – 587 Surge Voltages

G. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements).
   1. The complete emergency lighting central battery inverter assembly; including circuit protection devices, meter, housings/enclosures, batteries, accessories, supports/anchors etc., shall be designed, manufactured, and tested.
      a. Wind loading all outdoor equipment locations.
      b. Earthquake Seismic Requirements of CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.
   2. Shall withstand, survive, and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
   3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance test seismic qualification of proposed equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.

PART 2 - PRODUCTS

2.1 OPERATION

A. General
   1. The Emergency Lighting Battery Unit (ELBU) shall be self-contained, automatic operation. Unit shall store electrical energy and supply standby back-up electrical energy upon failure of normal (utility source) power and provide operation of lighting and other connected equipment as described in the Contract Documents.
   2. ELBU shall consist of an automatic circuit transfer system, input/output circuits, storage batteries, battery charger, voltage inverters, monitoring, test/monitoring equipment and operating program software. Manufactured with all components enclosed in modular cabinetry.
   3. ELBU volt-ampere continuous load rating shall be as shown on the Drawings,
   a. Normal mode load capacity operation duration shall be continuous.
   b. Emergency mode full 100% rated load capacity operation shall be for the duration time indicated on the Drawings, but not less than 90 continuous minutes.
   4. Unit shall operate properly in ambient temperatures from 15 to 25 degrees centigrade, sea level to 10,000 feet above sea level, at the specified ratings.
   5. Emergency lighting central battery unit shall be as manufactured by Emergilite, Isolite, Dual-Lite, or Myers Power Products.

B. Operation
   1. During operation under normal mode 60Hz AC power, the supply voltage shall feed both the output load and the battery charger. Upon normal power failure, the output load shall be automatically transferred to internal 60Hz AC emergency mode power operation.
   2. When normal power is re-established, the output load shall be automatically transferred back to the normal power AC line and the charger shall commence recharging the batteries to their full capacity.
   3. Transfer to emergency mode operation shall occur when normal input voltage drops to less than 60% to 70% of nominal for brownout protection on any input line phase. The transfer to emergency mode shall also occur if there is an open circuit, or shorted circuit on the normal input side. A 15 to 60-second transfer time delay (nominal) back to normal mode

operation shall be adjustable to reduce "cycling" operation between normal and emergency operating modes.

2.2 LOAD REQUIREMENTS

A. Load Types
   1. Load output shall be provided for the following types of loads in any loading combination (0 to 100% of load rating), within the rated capacity (0 to 100% of load rating) for 50% (0.5) lag through 50% (1.5) lead load power factors.
   2. Unit shall be suitable for operation and withstand inrush currents associated with the connected loads without damage or changes in its operation including LED (Light Emitting Diode) solid-state lamps and drivers.

B. Load Output: system shall be constant on.

C. Load Output Voltage Characteristics
   1. During the entire rated operation duration, output voltage shall be sinusoidal wave.
      a. Total harmonic distortion shall not exceed 5% under any combination of the specified load conditions.
      b. Voltage regulation shall not vary more than plus or minus 5% of rated voltage under all load conditions, no load 0% to 100% of full rated load.
   2. Load output voltage frequency regulation shall be within plus or minus 0.5Hz under specified load conditions, when operating on the inverter and batteries.

E. Efficiency When Operating In Any Mode
   1. At 100% rated load – greater than 97%.
   2. At 50% rated load – greater than 94%.
   3. Efficiency shall be measured load output kW divided by the measured line input kW; with a connected load power factor of 0.8 lagging and the batteries fully charged operating on trickle float charge.

2.3 INVERTERS

A. General
   1. Inverters shall be modular and completely solid state. Protected against over-loads, in rush loads and short circuits.
   2. Inverter shall provide stable regulated output operation from the internal batteries under all specified load conditions.
   3. Low battery voltage cutout shall be provided to disconnect the inverter load when the battery output voltage drops below a preset value.
   4. Automatic unit restart after initiation and/or restoration of normal input power.

2.4 CONTROL, TESTING AND MONITORING EQUIPMENT

A. Internal control, monitoring and testing with programming software and micro-processor control operation shall be provided to verify proper system operation and trouble conditions. Control, testing, and metering display panel shall be installed in the door of equipment cabinet not more than 6-feet-0-inches above finished floor.

B. System Display/Control Panel
   1. The system's display panel shall include an array of visual indicators, multi-line alphanumeric character display, and a keypad to control and monitor the system.
   2. The array of visual indicators shall monitor and annunciate the AC utility presence, system ready status, battery charging status, battery emergency operation, and alarm functions.
   3. The system shall display alphanumeric meter functions including:
      a. Input-voltage and input demand load.
      b. Output-voltage, output-frequency, output-demand load and output-power factor.
      c. Unit internal component temperatures.
      d. Total quantity of power outages and inverter operating time.
   4. To ensure only authorized Personnel can operate the unit, the system shall be password protected for all control functions, including parametric changes.

C. Alarms
   1. The system shall have audibled and alphanumeric visual alarm display, with automatic logging of the twenty most recent alarm events. Each alarm will have a corresponding audible signal associated with it to aid in the troubleshooting of the system.
   2. The system's alarm acknowledge feature shall enable the user to silence only the current audible alarm(s), while not silencing other alarms and not clearing the alarming condition until the fault has been cleared.
   3. Alarms shall monitor low, near low, and high battery voltage; high AC voltage input; high and low AC voltage output; volt-amp output overload; low runtime remaining; high ambient component temperature over limit; check charger, battery, inverter, and memory/logic; emergency power off activated; user test check; and call service.
   4. Alarms on each internal circuit breaker, to indicate when the circuit breaker is in the open/off/ tripped positions.

D. Manual and Programmable Testing
   1. The system shall provide both manual test functions and software programmable automatic test modes. The user shall be able to perform a system test at any time.
   2. The system shall also perform an automatic programmable, weekly, self-diagnostic test and load test of its subsystems to ensure the system will operate in an emergency condition. A monthly load test for a user programmable discharge time and an annual test for a complete runtime discharge time and an annual test for a complete runtime discharge.
   3. Automatic recording in memory, of the last twenty inverter events, including all automatic weekly and user programmed tests, shall be logged.

E. Remote Terminal Strip
   1. An auxiliary terminal strip located within the system cabinet shall provide connection points for remote monitoring of inverter status and alarm indication.
   2. Remote monitor/annunciator panel:
      a. Provide a remotely mounted ELBU monitoring/alarm panel, with operating status and alarm conditions visual and audible indicators. Provide an audible alarm silence push-button with automatic resound on subsequent alarms.
      b. The panel shall be enclosed in a NEMA 1 for indoor locations, NEMA 3R for outdoor locations. Flush mounted housing, with "see-thru" front cover access door. Tamper resistant construction, suitable for installation in unsupervised public areas.
      c. The remote monitoring and alarm panel shall operate over connecting circuit lengths up to not less than 300-foot distance from the respective ELBU.
      d. Provide remote monitoring and alarm panels adjacent to each fire alarm annunciator panel unless noted otherwise on the Drawings.

2.5 BATTERIES

A. General
1. Batteries shall provide capacity to operate the unit and maintain specified inverter output for indicated years on a pro-rata basis when properly maintained as recommended by the Manufacturer.
2. Flame arresting caps shall be provided on batteries, with catalytic conversion to prevent hydrogen out gassing.
3. Battery cases shall be translucent to allow visual observation of electrolyte level. Provide earthquake restraint battery mounting straps.

B. Battery Seismic Restraint
1. Batteries shall be installed in the unit with seismic restraint anchors and straps.

C. Battery Type
1. Batteries shall be nickel cadmium low maintenance type to reduce the need to replenish battery fluids. Batteries shall be 20-year design life expectancy at 77-degrees Fahrenheit ambient, pocket plate construction. Maximum battery discharge shall be automatically limited to the value recommended by Battery Manufacturer of nominal battery voltage, with full rated unit output during discharge.

2.6 BATTERY CHARGER

A. General
1. Battery charger shall be solid state specifically designed for the type of batteries used in the system.
2. Battery charger shall have automatic protection against short circuits, low battery condition, DC-over voltage protection and protected against thermal runaway.
3. Charger shall automatically maintain correct battery charge conditions, with float charging and periodic equalize battery charges, within plus or minus 0.05 volts of Battery Manufacturer’s recommendations.
4. The charger shall completely restore fully discharged batteries from the input line source to full battery charge condition in less than 24 hours.

2.7 CABINET

A. General
1. The cabinetry shall contain all components, inverter, transformers, power supplies, battery charger, including the batteries, free standing with hinged locking door. All components shall be accessible from the front for maintenance and removal.
2. Units requiring side access for cooling air or maintenance shall not be acceptable unless the Drawings specifically show the permitted side access space provisions.
3. Provide water shields on cabinets, to protect the ELBU from fire sprinkler discharge water damage.

B. Cabinet Construction
1. The cabinets shall be metal, NEMA 1 enclosure, equipped with a key-operated access lock.
2. Manufacturer’s standard finish color with rust inhibitor “primer” and acid-resistant finish paint.

3. Battery shelves shall permit the batteries to be tested or have battery fluids added without having to remove the batteries.
4. The doors shall open full without affecting the operation of the unit. Conduit knockouts shall be provided on both sides, bottom and top of the cabinet for connection of line and load circuits. Provide dead front or insulated covers over exposed energized parts to prevent accidental contact when doors are open.

C. Electrical Connections
1. Provide line and load terminal lugs and identification tags on all circuits.

D. Size
1. Maximum cabinet size including batteries shall not exceed those shown on Drawings.

PART 3 - EXECUTION

3.1 TESTING

A. General
1. All units and batteries shall be inspected for damage as soon as they are received. Specifically check to see if wet cell batteries have been turned over in shipment and whether the equipment cabinets have received any severe dents which might cause internal damage. Remove and replace all damaged equipment with new undamaged equipment.
2. Use only the factory provided knock-out areas and conduit entry provisions on the equipment for wiring. Care shall be taken not to let metal slugs or chips get into the equipment cabinet.
3. Prior to energizing equipment, perform measurements on the incoming and load output AC lines to the equipment to ensure that the proper voltage level is available and that there are no ground faults or high potentials between conductors or between phase conductor to neutral/ground.
4. Prior to installing the fuses, or closing the circuit breaker in the battery circuit, verify correct battery voltage, polarity markings, battery electrolyte level and all electrical connections are secure.
5. Prior to turning the system on for any tests, the unit shall be bypassed with the mains connected to feed the load directly and the currents in each conductor measured and balanced. Follow Manufacturer's instructions for installation, connection and energizing equipment.
6. Batteries which are shipped with the electrolyte in the battery cells shall be maintained on a float charger when not installed and energized, operating the emergency power unit. Batteries shipped without electrolyte installed in the battery cells shall not have electrolyte added until equipment is installed and ready to be energized. Batteries which are not handled with this procedure will be rejected, shall not be used and shall be replaced with new batteries at the Contractors expense.
7. Provide factory authorized Field Service Technician factory start-up to inspect, energize, test and certify the correct system installation, connections and operation. Provide written acceptance field service report, six copies, to District's Representative.

B. Commissioning (Additional Requirements)
   1. Setup, testing, startup, and commissioning shall be performed by Factory Technician(s) trained, certified and authorized by the Equipment Manufacturer. Final commissioning shall be performed after installation and connections are complete.
   2. Provide system programming and setup of all control sequences for the emergency/exit lighting control system.
   3. Simulate normal source power failure by opening (turn-off) building main service disconnect and verify connections and operation of each electrical system device connected to the system on both normal power source and emergency power sources. Simulated test time for operating duration connected on the emergency systems shall be not less than 90 continuous minutes without failure or anomalies in the system.
   4. Record and document electrical demand load and sequence of operations on the ELBU system with all connected loads operating, including but not limited to:
      a. Fire alarms
      b. Egress/exit lighting
      c. Doors
      d. auto-loading and overload shedding controls
   5. Test all control system functions after the installation and connections are complete and the system has been energized. Verify each control sequence of operation and each device to be controlled are each operating correctly.
   6. Record and document each device setup and program setting.
   7. Submit written report (six copies) to District's Representative certifying commissioning has been performed; all respective systems are operating correctly and document all software setup and each device setting.
   8. Refer to General Commissioning Section 01 91 13 for Additional Requirements.

3.2 SEISMIC EARTHQUAKE

A. General
   1. The entire unit shall be installed and anchored to building structure to comply with Seismic Earthquake Requirements.
   2. Install seismic restraints on all batteries.

3.3 FACTORY SERVICE AGREEMENT (FIRST YEAR OPERATION)

A. General
   1. Provide site visits and written reports for each ELUB at unit start-up, commissioning, and again approximately 12 months after completion of testing and commissioning. Shall be included as part of the Base Contract Scope.
   2. Factory authorized Technician shall test all ELUB options, accessories and functions, physical, electrical, and mechanical inspection. Simulate normal source power outage and recharge functions.
   3. The Base Contract initial first year operation service scope shall be renewable, if mutual agreement between the ELUB Manufacturer and the District is accomplished for service cost, scope and renew.
   4. Provide factory service proposal renew agreement to the District's Representative.

END OF SECTION 26 52 00

SECTION 271000 - STRUCTURED CABLING

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26.
   2. General Provisions and Requirements for electrical work.

B. Provide a structured cabling system for data and communications. Using the conduits and raceways shown on Plans provide the following cables from the existing Campus Main Distribution Frame (MDF) to the new Intermediate Distribution Frame (IDF) in the new Classroom Building:
   1. 12-strands of multimode fiber optic cable.
   2. 12-strands of single mode fiber optic cable.
   3. 25-pair Category 5 copper cable.

C. Using the conduits and raceways shown on Plans provide the following cables from the Intermediate Distribution Frame (IDF) in the new Classroom Building to a new sub-IDF in the new Administration Building.:
   1. 6-strands of multimode fiber optic cable.
   2. 6-strands of single mode fiber optic cable.
   3. 12-pair Category 5 copper cable.

D. Provide Category 6A connectors in outlet boxes in the new Classroom Building as shown on plans. Provide Category 6A cable from each connector to the Classroom Building IDF.

E. Provide Category 6A connectors in outlet boxes in the new Administration Building as shown on plans. Provide Category 6A cable from each connector to the Administration Building IDF.

F. Examine the existing computer network cabling system in the existing campus and provide patch panel and accessories in existing MDF rack as required to terminate new cables.

G. Install and connect District-furnished network electronic equipment in each new IDF rack

1.2 EQUIPMENT QUALIFICATIONS

A. Equipment
   1. Network systems infrastructure equipment and materials shall be the products supplied by Corning and Belden or equal.
   2. The Supplier of the equipment shall be the factory authorized Distributor and service facility for the brands of equipment and material provided.

B. Installation Certification
   1. Work and material for cables, cable terminations, outlets and related components for infrastructure systems shall be performed by Certified Installers. The Installer shall be certified by the Respective Product Manufacturers.
   2. The Manufacturers of the indicated work and material shall provide an Installer education / training and certification program for the supplied products.
   3. The Installers performing the Contract work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.

C. Extended Material and Performance Warranties
   1. In addition to the Warranty Requirements described elsewhere in the Contract Documents, provide the following extended material and performance warranties. The warranty period shall be for not less than 20-years from the Contract Notice of Completion.
   2. Warranty scope includes materials and performance for network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices, and connectors.
   3. Repair or replace the defective material with new material at the project premise, to comply with the Performance Standards outlined in the Contract Documents during the warranty period.

1.3 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Manufacturer's standard catalog data for each component. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of items.

B. Submit Manufacturer's Certifications for each Installer performing the work. The submittal shall be approved by the Owner's Representative prior to initiating any related Contract Work.

C. Submit extended warranty statements.

D. Provide proposed nameplate and outlet identification/color coding system. Indicate proposed identification naming sequence and methods, itemized for review.

1.4 APPLICABLE STANDARDS

A. Individual Component Production/Manufacturer Testing and Labeling.
   1. The equipment shall be UL listed, labeled, and approved for the application shown in the Contract Documents.
   2. ETL (USA) each network systems infrastructure component. Third party testing, documentation, and certification for performance compliance of each component with the UL, ANSI, and TIA Applicable Standards specified in the Contract Documents.

B. The complete system material, equipment, testing, installation, workmanship and installed performance shall comply with the Mandatory Requirements and the Guideline/ Recommendation Requirements of the following latest published version, supplements, latest revision including Addendums and TSB. Both the mandatory and advisory criteria shall be included as Requirements of the Contract Documents:

1. TIA 526: Optical Power and loss measurements – multimode and single mode fiber.
2. ANSI/TIA/-568C: Commercial Building Telecommunications Standards.
3. ANSI/TIA/-569B: Commercial Building Standards for Telecommunications Pathways.
4. ANSI/TIA/-570A: Residential Telecommunications Standard.
5. ANSI/TIA/-598B: Optical Fiber Cabling Color-coding.
6. ANSI/TIA/-606A: Administrative Standard for Commercial Telecommunications Infrastructure.
7. ANSI/TIA/-607: Commercial Buildings Grounding and Bonding Requirements for Telecommunications.
8. FCC – FYU/FT6.
9. ISO/IEC 11801
10. National Electrical Code (NEC) and California Electrical Code (CEC) including Articles 770 and 800 with ETL verified Testing and Local Code jurisdictions.
11. NECA/NEIS, National Electrical Contractors Association, National Electrical Installation Standards:
    a. 301 – Standard for Installation and Testing for Fiber Optic.
    b. 568 – Standard for Installing Building Telecommunications Bonding and Grounding.
    c. 607 – Telecommunications
12. Manufacturer's recommendations for the respective equipment.

C. The entire completed Electronic Network Systems Infrastructure shall be tested and provide electronic data/network and telephone/voice multi-channel communications latest revisions, Standards and Addendums for the following protocols:
1. IEEE 802.3/ETHERNET latest revisions:
    a. 10Mbps 10Base-T, 100Mbps 100Base-Tx, and 1000Mbps (1Gbps) 1000 Base-Tx for copper wire; 100-meter communications pathway distance.
    b. 10Mbps 10Base-F1, 100Mbps 100Base-FX, 1000Mbps 1000Base-Lx-Sx and 10,000 Mbps (10Gbps) for fiber optics; 550-meter communications pathway distance, OM4 Standard.
    c. IEEE-802.3 for Power Over Ethernet (POE) and Power Over Ethernet-Plus (POE Plus).
2. FDDI - Distributed data interface on fiber or copper wire, 100Mbps.
3. 100VG – Any LAN
4. TIA/EIA serial and Bi-directional RS-232 and RS-485, including Star-Hub repeaters.
5. ANSI - TPPMD 55Mbps, 155Mbps and 622Mbps Asynchronous Transfer Mode - ATM.

D. The complete telephone/voice infrastructure system shall be suitable for the telephone/voice analog and digital communications and VOIP protocols. The system shall be compatible with the telephone/voice equipment installed as part of the Contract.

E. Installation of all infrastructure equipment, devices, splices, terminations, cables, outlets, etc. shall comply with Manufacturer's recommendations.

1.5 ABBREVIATIONS

Abbreviation	Terminology
ACR	Attenuation to Cross Talk.
AHJ	Authority Having Jurisdiction.
Backbone	Circuit interconnections between MDF and IDF patch panel locations.

dB	Decibel.
dBm	Decibel referenced to a milliwatt.
Demarc	Demarcation location where operational control change occurs or ownership change occurs.
ft.	Feet.
GHz	Gigahertz.
Gbps	Gigabits per second.
Horizontal Connection, and/or Horizontal wiring	Circuit interconnections between individual workstation outlet location to respective IDF or MDF equipment rack patch panel.
IDF	Intermediate Distribution Frame (horizontal or vertical cross connect) for an individual building area/floor.
km	Kilometer-lkm.
kPSI	1000 pounds per square inch.
m	Meter = 39.37 inches.
Mbps	Megabits per second.
MDF	Main Distribution Frame (central/main cross connect) for multi-building site or for a single individual building.
MHz	Megahertz.
MIC	Micrometer
mm	Millimeter = $l0^{-3}$ meter.
NEXT	Near end cross talk.
nm	Nanometer = 10^{-9} meter.
pF	Picofarad = 10^{-12} farad.
Provide	Furnish, install, and connect.
RTDE	Equipment rack mount fiber optic termination distribution enclosure, with fiber optic patch panel.
RMSE	Equipment rack mount fiber optic enclosure, splice only (without patch panel).
STP	Shielded individual twisted pairs copper wire.
ScTP	Shield Screened Twisted Pairs copper wire.
um	Micrometer = 10^{-6} meter.
USE	Universal Splice Enclosure.
UTP	Unshielded twisted pairs copper wire.
VOIP	Voice communications Over Internet Protocol.
WGNA	WideBand Gigabit Networking Alliance.
Workstation or Workstation location	Spaces remote from the MDF/IDF terminal room/closet, where user equipment interacts and connects with the electronic systems infrastructure equipment connection outlet device.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLES

A. General
1. Operating temperature range - 20 degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.
2. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc.,

and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled "Limited Combustible Cable" (LC or LCC) and shall comply with the latest published revision of all the following Additional Requirements.

a. Limited combustible "FHC-25/50" per UL-2424.
b. NEC/CEC; CMP, additional listing/labeling where the install location is an environmental air plenum, fiber optic "FHC-25/50-CMP and/or OFNP/OFCP".
c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
d. NFPA-5000; defines combustible material including wire and cable.
e. NFPA-75 computer rooms and electronic equipment rooms.
f. NFPA-13; spaces containing "limited combustible loading".

3. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaint.
4. All fibers in a multi-fiber cable shall be fully operational within the performance characteristics specified prior to and after the cable is installed. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cables shall be removed and replaced with fully functional cables at no additional cost to the Contract.
5. Cables shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with Specified Requirements. ANSI/TIA-568C including related Standards, Amendments, and TSB.
6. Each fiber shall be individually identified with factory color-coding or factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model, and catalog number, along with Agency Listing Identification.
7. Fiber optic cable shall be a product of the same Manufacturer, including portable patch cables.
8. Cables installed in raceways or conduits below grade, through in-grade manholes or pull-boxes shall be rated for installation in water/wet locations.
9. Provide overall outer jacket enclosing all fibers inside jacket. Cables containing less than seven fiber strands shall be provided with a color-coded outer jacket (red or orange).
10. Multimode (50/125)
    a. 50/125 fiber optic cables optical fibers, graded index multimode optical glass fibers, 50.0-micron fiber core and 125-micron fiber cladding, 0.2 numerical apertures. Optical fibers shall be 100 kPSI proof tested, with maximum 0.7-micron flaw size for dual operation at 850nm and 1300nm wave lengths.
    b. Minimum bandwidth:
       @ 850nm-wavelength 3500MHz per km length
       @ 1300nm-wavelength 500MHz per km length
    c. Maximum attenuation:
       @ 850nm-wavelength 3.0dB @ 1km length
       @ 1300nm-wavelength 1.0dB @ 1km length
    d. Laser-optimized "OM4" optical multi-mode standards.
11. Single mode:
    a. Fiber optic cables optical fibers, (8.3/125) single mode optical glass fibers, 8.3-micron core fiber and 125-micron fiber cladding, 0.11 numerical aperture. Optical fibers shall be 100-kPSI proof tested, with maximum 0.7-micron flaw size. For operation at 1310nm and 1550nm wavelengths.
    b. Maximum attenuation:
       @ 1310nm- wavelength 0.5 dB @ 1km length
       @ 1550nm- wavelength 0.4 dB @ 1km length
    c. Maximum dispersion
       @ 1310nm- wavelength 2.8 ps/nm km length
       @ 1550nm- wavelength 18.0 ps/nm km length

d. Laser-optimized "OS1"/OS2" optical single mode standards.

B. Loose Tube Gel-filled Cables
1. Multiple, loose tube buffer tubes, gel-filled. Each buffer tube shall contain the same quantity of optical fibers, but not more than 12-optical fibers in each buffer tube.
2. Buffer tubes shall be cabled around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
3. Aramid yarn, non-optical, strength fibers shall extend continuously along the length of the cable.
4. The cable interstitial spaces shall be flooded to inhibit water migration, with non-flammable water blocking gel.
5. Each optical fiber shall be individually UV cured acrylate coated, 250-micron diameter coating over fiber cladding.
6. A seamless black polyethylene outer layer jacket shall envelope the entire cable.
7. The cable shall be fungus resistant, UV resistant, and moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed race-way/conduit and manholes/pullboxes continuously flooded with water.

C. Indoor/Outdoor Cables
1. The cable shall be fungus resistant, UV resistant, moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/ conduit and manholes/pullboxes continuously flooded with water, and in conduits exposed to the sun.
2. Each optical fiber shall be primary coated with 500-micron uniform acrylate tight buffered and with elastomeric uniform 900-micron diameter tight buffered, secondary coating. Aramid yarn strength member elements shall be tensioned and symmetrically and uniformly distributed around the fibers, along the length of the cable.
3. An overall cable jacket uniformly extruded directly around and mechanically interlocked with the optical fibers/strength members. The extruded jacket shall form internal helical cusped ridges that interlock with the optical fibers and strength members. The interlocking jacket shall not allow cable fibers to move axially within the cable jacket.
4. Cables containing more than 24-optical fibers shall be constructed with sub-cable fiber bundles. Each sub-cable bundle shall contain equal quantities of optical fibers, with a separate PVC jacket around each sub-cable. Sub-cable and sub-cable jacket construction shall match the overall Cable Requirements and Jacket Requirements.
5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.
   a. CEC -OFNR (Vertical Riser Type Locations) OFNP (UL FHC-25/50 LC Plenum Type Locations and locations where not continuously enclosed inside conduits for entire cable length).
   b. CEC -OFNG (where continuously enclosed inside conduits for entire cable length).

2.2 COPPER WIRE CABLES (TWISTED PAIRS)

A. General
1. Conductors shall be copper wire, individually insulated and color-coded, with multiple conductors arrange in twisted pairs.
2. An overall non-conductive jacket shall encase the copper wires and any shielding (where shielding is specified) shall also be encased by the jacket.

3. Cables shall be UL listed, complying with NEC National Electrical Code, National Fire Protection Agency and NFPA Requirements for each installation location shown. ETL tested and certified to comply with or exceed Specified Requirements.
   a. CEC-MPP/CMP, FHC-25/50 (plenum type locations and locations where not continuously enclosed inside conduit).
   b. CEC-MPR/CMR (Vertical riser type locations).
   c. ANSI/TIA/-568C; including related Standards, Amendments, and TSB.
4. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled "Limited Combustible Cable" (LC or LCC) and shall comply with the latest published revision of all the following Additional Requirements.
   a. Limited combustible "FHC-25/50" per UL-2424.
   b. CEC: CMP, additional listing/labeling where the install location is an environmental air plenum, copper wire "FHC-25/50-CMP".
   c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
   d. NFPA-5000; defines combustible material including wire and cable.
   e. NFPA-75 computer rooms and electronic equipment rooms.
   f. NFPA-13; spaces containing "limited combustible loading".
5. Cables shall qualify as 100% recyclable materials disposal, RoHS regulation complaints.
6. Cables installed in air plenums, air handling spaces and cables installed without raceway or conduit shall also be UL listed and labeled for installation in air plenums.
7. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number and agency (AHJ) listing identification.
8. Cables installed in raceways or conduits below grade, through in-grade manholes and pullboxes shall be rated for installation in water/wet locations.
9. Copper wire Electronic Network Systems Infrastructure cable shall be a product of the same Manufacturer, including portable patch cables.
10. The outer jacket of cables with less than nine pair of conductors shall be color-coded. The jacket color shall be different for each system type; multimedia; telephone/voice; computer/data network; and fiber cable jackets.
11. 300-volt RMS insulation material for each data conductor shall be the same material; shall be the same electrical characteristics and shall be the same dielectric constant, for all data conductors contained within the respective common cable jacket, along the entire installed length of the cable. Data cables employing differing insulation materials for individual data conductors contained within a common cable jacket are not acceptable and shall not be provided.
12. Propagation and "Skew" Rate
    a. Skew rate (nominal velocity of propagation delay) between any twisted pair in a combination of four twisted pair conductors grouped in the same cable, shall not exceed 35-nano seconds between any wire pair contained in the conductor group, and as required by the cable Category rating, over a cable length of 328-feet (100 meters), for all frequencies up to the cable maximum frequency rating.
    b. Nominal velocity of propagation, exceeding 70% of the speed of light.

B. Category-6A Computer/Data Cables – UTP
   1. Category-6A cables and patch cords shall comply with ANSI/TIA-568-C.2 Category 6A and Amendment 1 to ISO/IED 11801:2002 Class E up to 500MHz.
   2. Category 6a cables shall be blue in color. Patch cords shall be yellow.

C. 25-pair and 12-pair Cat 5 cables shall be rated for use in underground conduits in wet locations.

2.3 FIBER OPTIC FIBER SPLICES

A. General
1. Fiber optic cable splices shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/ TIA/EIA – 568C including related Standards, Amendments and TSB.
2. Fiber optic splices shall be the product of the same Manufacturer.

B. Mechanical Splice
1. Mechanically splice each fiber with a splice suitable for use with the type of fiber optic fibers. Re-enterable and reusable splice. Splice shall be recommended as compatible with the optical fibers by the Manufacturer. Splice shall not require the use of adhesives. Splice shall provide integral strain relief.
2. Performance Requirements after installation:
   a. Operating temperature range minus 20-degrees centigrade through plus 60-degrees centigrade.
   b. Loss variation over temperature range, 0.05dB or less at specified wavelengths.
   c. Insertion loss, 0.3dB or less at specified cable wave lengths.
   d. Reflection (return loss), -40dB at specified cable wavelengths.

C. Fusion Splicing
1. Fusion splicing shall be performed with equipment providing the following features:
   a. Cleaving and cleaning optical fiber.
   b. Integral splice optimization verification system with local injection and detection.
   c. Projection screen optics and fiber core alignment system.
   d. Fiber cleaning/stripping.
   e. Cleaning fiber ends and fusing of fiber together with an electric arc.
2. Fusion splice insertion loss as measured at the completion of the splice shall be less than 0.1dB at specified cable wavelengths.

2.4 FIBER OPTIC FIBER CONNECTORS AND INTERCONNECTION COUPLERS

A. General
1. The connectors and interconnection couplers shall be compatible, maintain the same performance Category rating, and be compatible with the corresponding fiber optic cable type attached to the connectors.
2. Fiber optic cable connectors and interconnection couplers shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed specified Requirements. Connectors and couplers shall comply with ANSI/TIA-568C, related Standards, Amendments, TSB, and TIA-Fiber Optic Connector Intermateability Standard (FOCIS) documentation.
3. Fiber optic connectors and couplers shall be the product of the same Manufacturer.
4. Shall be UL listed and comply with UL94V-0.
5. Color code connectors for fiber optic cables to match the respective fiber optic strand/ jacket color.

B. Fiber Optic Fiber Connectors
   1. LC – Small Form Factor (SFF) termination connector
      a. Ceramic oxide 1.25mm ferrule. Mechanical durability not less than 500-mating cycles. Insertion loss of mated connector shall be less than 0.3dB at specified wavelengths.
      b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide dust cover cap for each connector.
      c. Locking type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

C. Fiber Optic Fiber Interconnection Couplers
   1. Interconnection couplers shall be “like-to-like” compatible and shall provide "plug-in" coupling of two fiber optic cable connectors terminated with fiber optic fibers front-to-rear "in-line" together. The coupler shall provide interlocking, automatic optical self-alignment of two mating fiber optic connectors.
   2. The centerline to centerline spacing of the interconnection couplers shall allow removal and insertion of portable patch cords, fiber cable connectors for both “single” and “duplex” type fiber adapter connectors without interfering with adjacent connectors.
   3. Patch panel mounted interconnections couplers shall be factory pre-mounted to a modular nominal 0.09-inch-thick metal panel, couplers aligned and anchored on the plate.
      a. The metal panel shall be predrilled for standard EIA mounting in high-density 19-inch-wide metal patch panel frames.
   4. Interconnection couplers in workstation outlets shall be installed in outlet boxes with cover plates.
   5. Provide removable dust caps for the front side of each coupler.

2.5 COPPER WIRE OUTLET CONNECTORS

A. Connectors shall be Category 6A complying with ANSI/TIA 568C, female modular jack 8-position/contact "RJ-45" style, related Standards, Amendments.

B. Connectors shall comply with FCC part-68 Subpart F for gold plating.

C. Shall be UL listed and shall comply with UL94V-0

2.6 FIBER OPTIC FIBER DISTRIBUTION ENCLOSURES

A. General
   1. Fiber optic fiber distribution enclosures shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA–568C including related Standards, Amendments and TSB.
   2. Fiber optic fiber distribution enclosures shall be the product of the same Manufacturer.

B. Equipment Rack Mount Fiber Optic Termination Distribution Enclosure - RTDE
   1. The RTDE enclosure shall mount in an EIA standard 19-inches wide enclosed or open frame equipment rack assembly. The RTDE enclosure shall be metal, painted finish, Manufacturer’s standard color.

2. The RTDE shall provide the following self-contained functions internal to the RTDE assembly.
   a. Fiber cable termination.
   b. Fiber cable "pig-tail" splicing.
   c. Fiber cable patch panel.
   d. Fiber Cable Management, training, and strain relief.
   e. Individual fiber and patching port identification numbers, color-coding of incoming trunk and out-going distribution fiber ports.
   f. Plug-in fiber optic interconnection couplers for port-to-port patching with portable fiber optic patch cords.
3. Fiber splice drawers:
   a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open, and removable for easy access. Each drawer shall contain two fiber optic splice trays with tray holders.
   b. Drawers shall stack vertically one above the other in the RTDE and allow sufficient slack in all fiber cables for removal of the drawer and splice trays.
   c. Provide one sliding drawer and two splice tray assemblies for each group 24-individual fibers or fewer fibers per group) of fiber optic fibers terminated in the equipment rack, but in no case provide not fewer than two sliding drawers with splice tray assemblies in each RTDE.
4. Fiber cable patch panel
   a. Metal panel shall provide a patch port for each fiber consisting of metal panel mounted fiber optic interconnection couplers for each fiber optic fiber indicated to be terminated at the RTDE.
   b. The fiber optic fiber interconnection coupler shall be provided to match and be compatible with the fiber cable connectors. Quantity shall match quantity of terminated fibers, unless indicated otherwise on the equipment rack schedules.
   c. Nominal panel thickness 0.09 inches.
   d. Provide a minimum of sixteen unused spaces for additional couplers in the patch panel.

2.7 COPPER WIRE PATCH PANELS

A. General
1. Copper wire patch panels shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/ EIA-568C including related Standards, Amendments and TSB.
2. Copper wire patch panels shall be the product of the same Manufacturer.

B. Equipment Rack Mounted Patch Panel
1. Patch panels shall be standard EIA 19-inches wide metal panel with a maximum of 48 modular connectors per panel and 24 connectors in a horizontal row, quantity of panels as required for total quantity of connectors. Provide not less than two spare empty rows for future copper wire outlet connectors.
2. The patch panel shall provide the following self-contained functions.
   a. Copper wire cable termination including conductor/shield termination and strain relief.
   b. Plug-in copper wire outlet connectors for port-to-port patching with copper wire portable patch cords.

3. Horizontally mounted, cable support metal bracket shall be provided for each 24-outlet/ connector groupings. The brackets shall be bolted to the equipment rack located at the backside of the patch panel; the brackets shall support and provide strain relief for each incoming copper wire cable connecting to the patch panel.
4. The copper wire connector installed in the patch panel shall be the same configuration, Manufacturer and type as the corresponding copper wire connector provided in the remote workstation outlet locations connecting to the respective patch panel outlet, unless indicated otherwise.

2.8 EQUIPMENT RACKS

A. Mount new cable terminations facilities in existing MDF rack.

B. Freestanding racks:
1. An equipment grounding bus, nominal 19-inches long, UL labeled as a ground terminal bus, shall be provided on each equipment rack. The ground bus shall be bolted to the rack main metal frame member with 1-inch standoff non-insulating bolts. Provide a minimum of ten drilled and taped bolt holes in the ground bus with ground lug bolts, for connection of equipment grounding conductors to the ground bus, size to accept ground conductors' #14-#4 AWG.
2. Vertically mounted, cable management enclosed metal channels (aluminum or stainless steel) shall be provided full height, continuously along the side of each vertical rail of the equipment rack. The channels shall be bolted to the equipment rack. The channels shall train, and dress vertically routed portable patch cords connecting between outlet connectors located in the equipment rack or in adjacent equipment racks. Vertical metal channel nominal size 6-inches by 6-inches square with removable access covers.
3. Provide horizontal cable management panels with multiple cable training rings on each panel (not less than five rings for each panel). Management panels (for up to 24-outlet groupings) nominal 19-inches wide by 1.75-inch high by 3-inches deep and/or (for up to 48-outlet groupings) 3.5-inches high by 3-inches deep, for EIA rack installation. Rings shall provide horizontal routing and support by grouping portable patch cords connecting between patch ports in the same equipment rack or adjacent racks. Patch cords shall be grouped and bundled with "Velcro" tie wraps and shall not overlap patch fields or rack mounted equipment. The cable management panels shall be installed on both the front and rear of the equipment racks, mounted both above and below horizontally between groups of patch ports as follows:
    1. One cable management panel (front and rear of rack) for each group of 48 or less copper wire outlets for patch ports.
    2. One cable management panel (front and rear of rack) for each group of 48-fiber optic outlet patch ports.
4. The entire rack assembly including any support arms shall comply with seismic install location earthquake structural standards.
5. Provide Surge Protection Device with RF Suppresser (SPD) and Power Distribution Unit (PDU). 120 volt, 1-phase, 20-amp 60Hz AC plug horizontal strip, mounted in each equipment rack. Each unit shall contain not less than six "plug-ins" on the rear of the SPD and not less than two plug-ins on the front of the SPD protected outlet plugs.
6. Provide pre-drilled mounting holes the entire length of equipment vertical mounting frames, EIA-310D, 19-inches (nominal) wide standard spacing for indicated equipment. Racks shall provide 17.75-inches (nominal) equipment horizontal mounting space between vertical rails.

7. Equipment racks shall be Manufacturer's standard rust inhibitor primer. Manufacturer's standard color finish paint over primer, unless noted otherwise.
8. Floor mounted self-supporting rack, nominal 78-inches of usable mounting frame height for equipment.
9. Bolted or welded hot dip galvanized steel or gold irradiate finish aluminum support frame. Hardware shall be stainless steel.
3. Open 4-post type 24-inchesW. x 84-inchesH. x 30-inchesD.
6. Racks as manufactured by Chatsworth or equal.

C. Wall mounted rack shall be swing out type, 3-piece hinged with lockable doors and vented side panels, 24-inches W. x 48-inches H. x 24-inches D. Chatsworth "Cube-it" series or equal.

2.9 WORKSTATION OUTLETS

A. General
1. Cover plates shall be provided with labels behind a built-in protective plastic plate.
2. The outlet cover plates shall be factory pre-punched and formed to accommodate the installed outlet connector with attachment screws.
3. Workstation outlets shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA-568C including related Standards, Amendments and TSB.
4. Workstation outlets shall be the product of the same Manufacturer.

B. Computer/Data Workstation Copper wire Outlets
1. The outlets shall be the same configuration and type as the corresponding connector provided in the copper wire patch panel outlet, unless noted otherwise.
2. ANSI/TIA-568C, and related Standards, Addendums and TSB.
3. The copper wire outlet connectors for twisted pair wire connections in computer work-station outlets shall be universal outlet connector RJ-45 type.

2.10 PORTABLE PATCH CORDS

A. General
1. Provide portable patch cords for all copper wire and fiber optic cable infrastructure outlets.
2. Patch cords shall be factory assembled tested and certified with factory terminated plugs at each end. Field terminated portable patch cords shall not be permitted. Terminated plugs shall incorporate integral bending radius limiting molded "boots" and strain relief. Patch cord assemblies shall be rated for "heavy duty", "high-abuse" service.
3. Patch cords shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. ANSI/T1A 568C related Standards, Addendums and TSB.
   a. CEC - OFNG/OFN for fiber optic portable patch cords.
   b. CEC - MPP/CMP/CMR/CMG/MPG for copper wire twisted pair portable patch cords.
4. Patch cords which are not installed shall be delivered to the Owner in cardboard boxes. The patch cords shall be neatly bundled and tied together. Mark each box with quantity and type of cords contained in the box.

5. Patch cords shall comply with the same Cable Communication Performance Requirements, Protocol Requirements and Testing Requirements as the respective infrastructure cables and outlets to which the patch cords are intended to be connected (plug-in). Patch cords shall be the product of the same Manufacturer.
6. The outer jacket of each portable patch cord shall be imprinted with date, Manufacturer's model and catalog number, and AHJ listing identification.
7. Provide a permanent, visible, factory applied identification number on each end of each patch cord. The identification number shall be the same on each end. However, the numbers shall increase sequentially on each patch cord and shall be unique and not duplicated on other patch cords. Permanently apply the identification numbers on the cable jacket or connectors.

B. Fiber Optic Patch Cords
1. Patch cord quantity: Provide six complete single mode duplex patch cord assemblies and six complete multimode duplex patch cord assemblies. Patch cords shall be 4-feet long and red in color.

C. Twisted Pairs, Copper Wire Portable Patch Cords
1. Twisted Pairs portable patch cords, general:
   a. "Male" eight positions modular "RJ" male style jacks install on each end of the patch cord cable. The jack shall be provided with a rear "fin" to prevent the plug tab from snagging when pulled backwards through adjacent wiring. RJ-45 style "male" jack, typical unless noted otherwise.
   b. Patch cord cable shall be UTP ANSI-Category 6A rating, shall match respective premise wiring, 4-pair twisted, stranded copper individually insulated wires, thermoplastic jacket over all the wires.
   c. Connectors shall comply with FCC 68.5 and Part 68 Subpart F.
   d. Connectors UL listed and shall comply with UL-94V-O.
   e. Contacts gold plated with not less than a 750 insertion/with drawl cycle rating.
2. Portable patch cord quantities and lengths for connecting port-to-port equipment rack patch panels
   a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire equipment workstation outlet patch port in the equipment rack patch panels. One-to-one straight through pin-to-pin wiring.

PART 3 - EXECUTION

3.1 STRUCTURED CABLE TESTING (ADDITIONAL REQUIREMENTS)

A. General
1. Provide end-to-end test of all individual optical fiber, individual copper wire conductors, each outlet and each connector in all terminated and unterminated cables, portable patch cord, outlets and patch panels provided in the Contract. Items shall be tested after installation as a complete channel pathway installation, splicing outlets and termination is completed.
2. The test equipment and (Tester) shall comply with the Accuracy Requirements for Field Testers as defined in the ANSI/TIA Standards for the specific cable type. The Tester including the appropriate interface adapter shall meet the specified Accuracy Requirements. The Tester shall be within the calibration period recommended by the

Vendor to achieve the Vendor-specified measurement accuracy. The Tester shall be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Contractor shall provide proof that the interface has been calibrated within the period recommended by the Vendor.

3. The Pass or Fail condition for the channel pathway link-under-test is determined by the results of the required individual tests (ANSI/TIA) any Fail result yields a Fail for the link-under-test. To achieve an overall Pass condition, the results for each individual test parameter must Pass. A Pass or Fail result for each parameter is determined by comparing the measured values with the ANSI/TIA test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field test. The Field Test Equipment Manufacturer shall provide documentation as an aid to interpret results marked with asterisks.
4. Provide all Test Equipment, Certified Testing Personnel, and setups. Shall comply with ANSI/TIA and Equipment Manufacturer's recommendations and standards of practice.
5. Provide electronic copy of all test reports to Owner's Representative.
6. The Contractor shall repair or replace equipment, cables, outlets, connectors, splices, terminations, etc. identified during testing as not complying with the Contract Documents, without additional cost to the Contract. Retest all replaced or repaired components at Contractor's expenses.

B. Twisted Pair Copper Wire paths shall be tested for Cat 6A performance.

C. Fiber Optic Cable Testing:
   l. Channel link insertion losses (dB) OLTS.
   2. Channel loop-back attenuation (dB).
   3. Channel signature optical time domain reflectometer OTDR, for installation characterization testing (event and attenuation resolution dead zone at specified wave-lengths, shall be less than 10-feet).
   4. Channel continuity and correct point-to-point matching terminals.
   5. Channel propagation delay and propagation speed.
   6. Channel fiber optic mapping, circuit length, and tracing.

3.2 CABLE INSTALLATION

A. General
   1. Cables connecting to equipment racks and terminal blocks shall be installed with not less than 6-feet of slack cable between the equipment rack/terminal block and terminal back-board. The slack cable shall be coiled and supported on the backboard and/or cable tray.
   2. Cables in terminal closets and terminal rooms shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12-inches on center mounted onto the plywood along the entire length of all cables.
   3. Provide separate routing paths on plywood backboards for fiber optic cables, computer data and copper wire cables and telephone/voice copper wire cables and multimedia, audio/ video, TV cables. Provide separate routing paths on plywood backboards for shielded copper wire cables and unshielded copper wire cables.
   4. Cables shall be routed parallel to floors and walls. Do not route cables diagonally on back-boards.
   5. Spare cable slack

a. Provide 25-feet of cable slack where un-terminated cables are specified at terminal backboards.
b. Provide a minimum of 18-inches of slack cable in each workstation outlet box and outlet locations.
c. Provide 10-feet of cable slack in ceiling above each workstation outlet.
d. Provide 24-inches of slack in each cable at patch panel locations.
e. Use Velcro straps to secure cables

6. Provide "horizontal wiring" cables installed from individual equipment locations and workstation outlets to respective MDF/IDF terminal closet/room patch panel. Cables shall be continuous without cutting or splices.
7. Provide "backbone" cables installed from each IDF location to respective MDF/Sub-MDF location terminal closet/room patch panels. Cables shall be continuous without cutting or splices.

B. Cable Pulling Lubrication
1. Cable pulling lubricants shall be specifically approved by the Cable Manufacturer. The following lubricants shall be used where approved by the Cable Manufacturer.
a. Slip X -300, American Colliod Co.
b. Bishop #45, Bishop Electric.
c. MacLube CA51, MacProducts.
d. Minerallac H2B, - Minerallac Electric.
e. Winter grade #7437-PC, General Machine Products.
f. Gel-lube 7/5, Cable associates.
g. Polywater, A, C, G - American Polywater.
2. Lubricants shall be continuously applied as cable enters raceway.

C. Cable Installation:
1. Do not pull conductors until factory test reports have been submitted and reviewed.
2. Minimum bending radius of fiber optic cables shall not be less than the following. Maximum pulling tension shall not exceed the following. In no case shall the Manufacturer's recommendations be violated.

Cable Type	Cable Fiber Quantity	Min. Bend Radius	Max. Pulling Tension
Loose Tube	2-84	9 inches	600 pounds
Loose Tube	86-192	10 inches	600 pounds
Indoor/outdoor	2-12	5 inches	400 pounds
Indoor/outdoor	14-24	7 inches	600 pounds
Indoor/outdoor	26-28	11 inches	1100 pounds
Indoor/outdoor	48-72	12 inches	1200 pounds

3. The minimum bending radius for copper wire cables shall be ten times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate Manufacturer's recommendations.
4. Cables installed in pullboxes on terminal backboards shall be installed on wall mounted cable support racks.
5. Provide a full 360-degree loop of cable around pullbox interiors.
6. For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves etc. shall be used to ensure proper cable pulling tensions and side wall pressures. Cables shall not be pulled directly around a short right-angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable-bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space, shall be provided in all situations, to insure

the minimum possible cable side-wall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.

D. Movement, Storage, and Handling of Cable:
1. Reels of cable shall not be dropped from any height, from trucks or other transporting equipment.
2. Lift and move cable reels using following methods:
a. Crane or boom type equipment-insert shaft (heavy rod or pipe) through reel hubs and lift with slings on shaft, with spreader or yoke to reduce or avoid sling pressure against reel head.
b. Forklift type of equipment may be used to move smaller, narrower width reels. Fork times should be placed so that lift pressure is on reel heads, not on cable, and shall reach all the way across reels so lift is against both reel heads.
c. Reels may be moved short distances by rolling. Reels shall be rolled in the direction indicated by arrows painted on reel heads. Surfaces over which the reels are to be rolled shall be solid clear of debris, and clear of protruding stones, humps, etc. which might damage the cable if the reel straddles them.
3. Storage of reels of cable:
a. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation.
b. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Additional covering such as tarpaulin, plastic sheeting, etc. shall be used if cable is to be stored outdoors.

3.3 CABLE TERMINATIONS

A. General
1. Infrastructure workstation outlets connecting to ports in patch panels and terminal blocks shall be grouped together in the patch panel and terminal block by outlet function, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
2. Polarity and color-coding of cable connections at splices, terminations, and outlets shall be consistently maintained throughout the entire electronic network system.
3. Terminate all cables onto respective outlets connectors, interconnection couplers and terminals. Terminations shall comply with Manufacturer's recommendations, ANSI/TIA-568C related Standards, Amendments, and TSB.
4. Fiber optic cable fiber strands and copper wire cable conductors terminated at outlet locations shall be connected with a strain relief device attached to the cable jacket to prevent cable tension from being transmitted to the termination connectors.
5. Cable terminations shall be performed to maintain the data transmission rates specified for respective entire system.

B. Fiber Optic Terminations
1. Individual fiber optic fibers shall each be terminated with a fiber optic LC type fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to ensure fiber “undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.

3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together (Duplex-Pair) for purposes of identification and connection transmit/ receive pair. Each pair of connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber duplex-pair interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.
4. Fiber optic cable fiber strands terminated at patch panels shall be installed with a minimum of 540 degrees of each fiber strand looped around the splice tray individual fiber “training” rings.
5. Fiber optic cable connecting from infrastructure workstation outlet to a fiber optic patch panel.
    a. The connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers.
    b. The patch panel coupler shall be color coded to identify the polarity of the transmitting and receiving optical fibers.
6. Fiber optic cable connections at workstation outlets.
    a. The connectors for fibers shall be "plugged" into separate physically adjacent fiber optic fiber interconnection couplers in the outlet.

C. Copper Wire Terminations
1. Where occurs, the shield on metal shielded copper wire shall be terminated and connected to the shield grounding connection at each termination point.
2. Twisted wire pairs shall not be untwisted for a length of more than 0.4 inches at any location and the cable jacket shall not be striped back not more than 0.5 inches any location including splices and terminations.
3. Unless specifically directed otherwise by the Owner's Representative, Pin assignment for wiring terminations shall comply with ANSI/TIA 568C type T568A or Type T568B as required to match the existing campus. The termination type shall be consistent throughout the Project Contract area.
4. Copper wire terminations shall be performed to maintain the transmission rates specified for the respective entire system.

END OF SECTION 271000

SECTION 274117 – AUDIO VIDEO SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26, 27 and 28.
   2. General Provisions and Requirements for electrical work.

B. The work under this section includes all labor, materials, equipment, and accessories required to furnish and install complete audio-visual system as shown on the plans and specified herein

C. The systems shall provide the capability of switching between images from computers, document cameras, or other A/V sources. The images will then be routed to either or both of the flat panel displays. Audio associated with the images shall be switched simultaneously to an amplifier which feeds ceiling mounted loudspeakers.

D. Announcements from the Public Address System shall interrupt the audio in the classroom system. When the PA announcement is complete, the classroom A/V system shall return to normal operation.

1.2 RELATED WORK

A. Document affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections of Divisions 01 and 26, 27, and 28 of these Specifications.

B. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.

C. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, back-boards, wiring, cables, equipment, devices, etc., shall be furnished and installed complete under this Section. Conduit and junction box sizes shall be determined by the Installing Communications Contractor for the particular wire and cable fills required for the systems installed (conduit sizes shall comply with the National Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for 1-year after final acceptance under this Section shall be the responsibility of the Communications Contractor.

D. The Installing Communications Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the

proper operation of the system so that the system shall perform the functions listed herein in compliance with all Specified Requirements.

1.3 GENERAL REQUIREMENTS

A. The Installing Communications Contractor shall hold a valid State of California C-10 License, shall have completed at least twenty projects of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least 5-years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

B. The Installing Communications Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work

C. The Installing Communications Contractor shall be a factory authorized Distributor and warrantee station for the brand of equipment specified and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Installing Communication Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at Contractor's shop. The Contractor shall employ factory-trained Technical/Service Personnel for service and maintenance of the system. Their resumes will be required. The factory-trained Technical/Service Personnel shall have a minimum of 5-years' experience installing the proposed system.

D. The Installing Communication Contractor shall have a Design Staff with a BICSI certified (RCDD) Registered Communications Distribution Designer. The Installing Communication Contractor shall have a factory trained Service Department. The Service Department shall be on call 24 hours a day, 365 days a year, to arrive and initiate onsite service the specified equipment upon a 24-hour notice.

1.4 QUALITY ASSURANCE

A. The switching and control equipment specified shall be exclusively as manufactured by Extron to match existing systems at the school.

B. All of the Electronic Systems Equipment shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the Manufacturer of all major equipment, which certifies that the Installing Communication Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the Manufacturer that they will have a Service Representative assigned to this area for the life of the equipment.

C. All communication systems supplied shall be listed by Underwriters Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the Contractor's submittal.

1.6 SUBMITTALS

A. Comply with all Requirements of the General Conditions, Supplementary Conditions and applicable Sections of Divisions 1 and 26 of these Specifications.

B. Additional Requirements of this Section are:
1. The submittal shall consist of three major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
2. The first section shall include installer qualifications including, letters of Extron factory authorization and guaranteed service, list of ten projects of equal scope to be used by the Contractor.
3. The second section shall contain an original factory data sheet for every piece of equipment furnished.
4. The third section shall contain block wiring diagrams for the system.

PART 2 – PRODUCTS

2.1 AUDIO VISUAL SYSTEM

A. Provide following Audio/Visual equipment including associated outlets, cabling, patch cords and raceways for complete operable Audio/Visual system in each classroom and in each room as indicated on Drawings.
1. One customized digital PlenumVault Direct View Classroom AV System, by Extron Electronics –including IP enabled switching system with integral audio amplifier and all components for complete integrated operation of the system.
2. TLP Pro 525M “Touch Link” touch panel.
3. Four (4) Extron #TLP Pro 525M flat speakers.
4. Display
   a. Provide Epson BrightLink 1485Fi interactive projector Lamp-free laser with mount above the white board in each room indicated on plans.
5. Provide Extron “Voice Lift” sound reinforcement system
6. Extron #VLM 3001 Single Pendant VoiceLift Pro Microphone.
7. Extron #IPCP Pro 250 xi IPCP Pro xi Control Processor.
8. Provide faceplates on all outlets. Face plates shall be white and shall include appropriate modular inserts to conform with System Requirements.
9. Provide patch cables for all furnished devices plus one 6-foot long HDMI cable at each input outlet.
10. Install and connect a District-furnished Apple TV device at each AV system.

B . Cables shall be Extron # XTP DTP 24P/35 35' cable or as recommended by Extron.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The wiring of the system shall be executed in accordance with the Drawings and the Equipment Manufacturer's wiring diagrams. Should any variations in these Requirements occur, the

Contractor shall notify the architect before making any changes. It shall be the responsibility of the factory authorized Distributor of the specified equipment to install the equipment and guarantee the system to operate as per Plans and Specifications.

B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

C. Cables shall be carefully cabled and laced with cable ties. All cables shall be numbered for identification.

D. The Contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The Contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.2 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of 1-year after final acceptance of the installation. The transmitter and receivers shall be warranted for parts and labor for a period of 3-years by the Manufacturer. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

B. The Contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

3.3 TESTING

A. Provide all instruments for testing and demonstrating in the presence of the District's Inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate System Specification

B. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the Requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

C. Check out and final connections to the system shall be made by a factory-trained Technician in the employ of a Manufacturer of the products installed. In addition, factory trained Technicians shall demonstrate operation of the complete system and each major component to the District.

D. System field wiring diagrams shall be provided to the District by the System Manufacturer prior to completion of the installation.

E. Upon completion of the installation of the equipment, Contractor shall provide to the District a signed statement from the Equipment Manufacturer that the system had been tested and functions properly according to the Specifications.

F. The Contractor shall be responsible to provide service within 24 hours (or by mutual consent) after notification by the District or his Representative, within the hours of 8:00 AM to 5:00 PM from Monday to Friday. Service request forms shall be supplied by the Contactor and the faxing or mailing of such request form shall constitute notification by the District of a service request.

3.4 TRAINING

A. Contractor shall provide a minimum of 8 hours of on-site training for site staff on the system. Training for Personnel shall be provided by certified technology specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, media retrieval procedures as well as operation procedures for local control configurations. The Contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and District's Representative.

B. Training for staff will include basic system concepts. Faculty and staff will need to know how to power on/off the system, and how to access one or more media resources via remote control. Training should include use and operation of audio/video devices and techniques and trouble-shooting tips. Trainers should incorporate hands-on techniques to maximize staff opportunity to incorporate and develop curriculum that is both meaningful and targeted for their student needs. Clearly written support materials should be provided to all training participants. Manual describing operation and use of the system shall also be provided.

3.5 RECORD DRAWINGS

A. The Contractor shall maintain record Drawings as specified in accordance with these Specifications, and as noted below.

B. Upon completion of the installation, four copies of complete operational instructions shall be furnished, complete with Record Drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source.

END OF SECTION 274117

SECTION 275126 - PORTABLE ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under Division 26.
   2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit block wiring diagrams and catalogs data showing component interconnection and descriptive literature for all component parts and cabinets.

1.3 EQUIPMENT QUALIFICATION

All Equipment shall conform to Federal, State and Local applicable Codes, Ordinances and AHJ, and shall be listed and labeled by Underwriters Laboratories.

1.4 REGULATORY REQUIREMENTS

A. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.

B. 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.

Capacity of Seating in Assembly Area	Minimum Number of Receivers	Minimum Number of Receivers Hearing-Aid Compatible
50 or less	2	2
51 to 200	2, +1 per 25 seats over 50 seats	2
201 to 500	2, +1 per 25 seats over 50 seats	1 per 4 receivers
501 to 1000	20, +1 per 33 seats over 500 seats	1 per 4 receivers
1001 to 2000	35, +1 per 50 seats over 1000 seats	1 per 4 receivers
2001 and over	55, +1 per 100 seats over 2000 seats	1 per 4 receivers

C. Provide a sign in each classroom and assembly area including the symbol for hearing loss in compliance with CBC 11B-216.10 and 11B-703.7.2.4.

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.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Assistive Listening System shall include the following items:
   1. Instructor (program source) wireless transmitter units.
   2. Student (audience) portable wireless receiver units.
   3. Plug-in microphones and earphones, for each unit.
   4. Multiple program source inputs for, Instructor's microphone, respective room audio/ video A/V system input/output and Instructor's computer audio input/output.
   5. System accessories.

B. Function
   1. The Assistive Listening System shall provide amplified available audio programs for hearing impaired students/audience, originating from classroom/stage/room instructors and audio/video instructional program source materials, and equipment in respective building spaces, rooms, classrooms and outdoor areas.
   2. The audible program shall be transmitted wirelessly from the program source to the student/audience, with reception coverage throughout not less than approximately 80% of the respective floor space/area space.
   3. Shall provide automatic stereo or mono audio full system operation, depending on program source input.
   4. The system in each space shall comply with Federal ADA, State and Local AHJ Requirements for the hearing impaired.

2.2 MATERIAL (INFRARED WIRELESS)

A. General
   1. All equipment shall be the product of the same Manufacturer.
   2. The receivers and transmitters shall be US Government FCC and Industry Canada-approved.
   3. Provide power on-off control on each unit, to extend battery duration.
   4. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.

B. Master (Program Source) Transmitter (Infrared Emitter) Units
   1. The infrared emitter/transmitter shall be compact, portable units, self-contained ABS/ plastic housing/enclosure.
   2. The emitter panel shall be a dual-channel system operating on both 2.3 and 2.8MHz invisible infrared light waves' frequencies. The channels shall be designated "CHANNEL A" for the left and "CHANNEL B" for the right.
   3. The emitter shall provide left and right AUDIO IN jacks to accept an input signal from a sound system, left and right "SYNC IN/SYNC OUT" jacks for master/slave daisy-chaining with other emitters if desired, and left and right "MIC-IN" jacks to accept an audio signal from a microphone or Audio/Video preamplifier.
   4. The emitter shall provide separate LED input level detectors for each channel which illuminate when the audio signal peaks. Stereo and mono audio processing.

5. The emitter shall be mounted by the following methods:
   a. Portable mounted to a table-top-or floor-stand, using accessory support-stand adapter.
6. Each emitter shall provide an array of not less than 130 infrared LEDs covered by an infrared transparent acrylic lens. The infrared signal from each emitter shall cover not less than 3,000 square feet (32,000 cubic feet) of enclosed space. Note: For room sizes smaller than 3,000-square feet, the infrared transmitter/emitter infrared output shall be reduced to accommodate the actual smaller room square feet size and height.
7. 120-volt 60Hz AC input to nominal 24-volt DC output (plug-in "power-brick") power supply external transformer shall be UL approved, with cable "plug-in" connection to emitter/transmitter. Provide remote system master on-off control.
8. Slave emitter/transmitter for rooms exceeding 30,000-cubic feet. Provide one additional infrared emitter/transmitter repeater slave unit, for each additional 30,000-cubic feet room volume, or fraction thereof. The slave repeater shall receive and retransmit the program signals from the master unit. Provide one 100-foot long "master-to-slave" auxiliary portable extension wire cable for each slave unit.
9. Provide a quantity of nine emitter/transmitter "master" units, plus additional "slave" units for adjusted room sizes.

C. Student/Audience Receiver Units
   1. Battery Power
      a. Power for each unit operation shall be supplied by internal, changeable recharge-able NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and/or with wall transformer/two-unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 15-hours with NiCad (NiMH) batteries.
      b. Provide power on-off control on each unit, to extend battery duration.
      c. A protection circuit shall prevent battery "back-drain" if the power to the charger is turned off while the unit is being recharged.
   2. The receiver shall be a dual-channel unit for wearing around the neck with an adjustable strap. Stereo and mono audio reception and processing.
   3. Compatible with the transmitter (emitter) and operate on 2.3 and 2.8MHz frequencies invisible infrared light waves. Self-contained and switchable from "CHANNEL A" to "CHANNEL B" through a switch located on the back of the unit.
   4. The receiver shall provide an infrared light-gathering lens on the front of the unit to focus the light signal from the emitter onto the infrared detector element. The receiver shall detect and decode the infrared emitter/transmitter light source within a 160-degree acceptance angle.
   5. Audio squelch circuit which turns the output circuit off when the infrared signal is reduced or not received, with on/off and volume control.
   6. Output jack, which accepts any of the listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.
   7. Shall be compact easily portable units, self-contained ABS/plastic housing/enclosure with red infrared receiver lens. Shall clip to pocket or belt.
   8. Provide quantity of four infrared receivers for each master transmitter.

D. Infrared System Accessories
   1. Battery recharger portable charger/organizer pack.
      Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitters and receivers' units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) receivers provided as part of the contract.
   2. Stereo audio headset style automatic noise canceling microphones, integral on-off-volume control and with behind the neck support style. Each with 25-feet long extension cables and outlet plug-jacks to match transmitter outlet jacks. Provide two cables for each emitter/ transmitter.
   3. Equipment wall mount support brackets.
   4. Auxiliary audio program source 15-feet long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
   5. Headset style earphones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
   6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each unit.
   7. Locking auxiliary equipment storage cases for cables, microphones and headsets. Quantity and capacity as required to store all accessories.
   8. Portable floor stand, for infrared emitter/transmitter units mounting and support, with variable height adjustment and tip-resistant weighted base. Provide one floor stand for each infrared emitter/transmitter.
   9. Locking, portable case for infrared emitter/transmitter. One for each emitter/transmitter unit.
   10. Provide microphone extension cable with plug to match microphone and infrared emitter / transmitter microphone input jack, 25-feet length. One for each microphone.

PART 3 - EXECUTION

3.1 GENERAL

A. Each System General
   1. Assemble, set up, and test each transmitter, receiver, and accessories units.
   2. Install and fully charge all batteries prior to and after testing/set up are complete.

B. Wireless Infrared Units
   1. Provide aiming and intensity adjustments of emitter/transmitter units to insure complete room coverage.

END OF SECTION 27 51 26

SECTION 275313 – PAGING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Sections for work related to those other Sections and required to be included as work under Division 26.
   2. General Provisions and Requirements for electrical work.

B. Provide new speakers in new building connected to existing systems in existing main campus. Examine existing campus paging systems and fully interface new construction into existing systems for function equal to existing speakers on campus.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets and descriptive literature for all component parts.

B. Submit Installer qualifications.

1.3 EQUIPMENT QUALIFICATION

A. All equipment shall conform to all local applicable Codes and Ordinances and shall be listed by Underwriters Laboratories.

B. The Supplier of the equipment shall be the Factory Authorized Distributor and service facility for the brand of equipment provided.

C. The intercom/paging and clock system equipment shall match existing on the campus.

1.4 INSTALLER QUALIFICATIONS

To qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be qualified Sound Contractor and shall hold a valid C61 License issued by the Contractors State License Board of California. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work. The Contractor shall be the factory authorized Distributor for the brand of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5-years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall be financially able to provide a performance bond covering the work and the guarantee described. The Contractor shall provide that bond if requested.

PART 2 - PRODUCTS

2.1 MATERIALS
Comply with Pertinent Provisions of all Sections in the Project Manual.

2.2 PAGING SYSTEM

A. Interior clock/speakers shall be IP based digital clock and speaker in a flush mounted white backbox and grille. Advanced Network Devices #IPSWDHD-MW with #IPS-DFM1 enclosure.

2.3 CABLING

A. Cable serving speakers shall be Category 6A copper computer grade cable as specified in Section 271000.

PART 3 - EXECUTION

3.1 CABLING
Category 6A cables shall be provided under Section 271000.

END OF SECTION 275313

SECTION 283100 - INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26.
   2. General Provisions and Requirements for electrical work.

1.2 QUALIFICATION OF BIDDERS AND EQUIPMENT

A. To qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be qualified Contractor and shall hold a valid License issued by the State of California Department of Consumer Affairs Collection and Investigation Services for the purpose of installing security systems. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction over the work. The Contractor shall be the Factory Authorized Distributor for the branch of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5-years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall be financially able to provide a performance bond covering the work and the guarantee described. The Contractor shall provide that bond if requested.

B. The equipment specified herein shall be exclusively as manufactured by Digital Monitoring Products (DMP) to match existing equipment at the site. No equals will be approved.

C. The system shall be serviced by a field supported 2-year warranty.

D. The Specification is based on the equipment of Manufacturers who have been approved by the District and the Manufacturers herein named shall be considered as meeting the Requirements of this Specification. For all items which are identified by part number and Manufacturer the Performance Specifications which are published in the most recent Manufacturer's data sheets available at the time of bidding this Project shall be applicable to the present work as though fully written out herein.

E. All equipment shall conform to all local applicable Codes and Ordinances and shall be listed by Underwriters Laboratories.

F. Installation Certification
   1. Work and material for cables, cable terminations and related components shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.
   2. The Manufacturers of the indicated work and material shall provide an Installer education/training and certification program for the supplied products.
   3. The Installers performing the Contract Work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.
   4. Submit Manufacturer's Certifications for each Installer performing the work. The submittal shall be approved prior to initiating any related Contract Work.
   5. Contract material installed, and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall done at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions. New material and work required to replace the non-compiling removed work and material shall be provided at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.

1.3 PERFORMANCE REQUIREMENTS

A. Investigate the existing campus intrusion detection system and provide all labor and materials required to fully expand and interface the existing system to serve the new construction.

B. Provide terminal cabinet, power supply, sensor devices, keypad, and interconnecting conduits, sleeves, pathways and cabling as required for a complete and operable system in the new building connected to the existing campus system.

C. Provide motion sensors in rooms with exterior glass and/or doors and/or hatches, and as indicated on Plans.

D. Provide keypad as shown on Plans.

E. Provide all programming and reprogramming required to fully interface the new building with the existing system.

1.4 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all switches, keypads, wiring devices, device plates, controllers, power supplies, cabinets, etc.

B. Submit Detailed Shop Diagrams including Dimensioned Plans, Elevations, Details, Schematic and Point-To-Point Wiring Diagrams and descriptive literature for all component parts and cabinets.

PART 2 - PRODUCTS

2.1 SYSTEM FUNCTIONS

A. Upon detection of an intruder by initiation of any device in the system, the system shall cause the annunciator LED to light and sound an alarm signal on the School's telecommunication system. Alarm information shall be sent by existing digital dialer to exist Central Station Alarm Monitoring Agency.

B. Systems shall detect the motion of a body taking not more than four steps in an area secured with motion detection equipment where entry doors or windows are possible access.

2.2 MOTION SENSORS AND CABLING

A. Motion Sensors shall be Honeywell Dual-Tec #DT6360STC Series ceiling mounted type. Sensors shall be dual performance, dual event devices to minimize false alarms or equal passive infrared devices detecting thermal motion signals. Sensor coverage patterns shall be as required for optimum coverage at each individual location.

B. Cabling shall be as recommended by the Manufacturer for system operation. Cables run in conduit below grade shall be rated by the Cable Manufacturer for wet locations.

PART 3 - EXECUTION

3.1 CONNECTIONS

All connections throughout the system shall be soldered, crimped by means of AMP lugs, fastened with screw type terminals, made by spring tension clip "punch block" terminals or make by standard plugs and receptacles. Each wire twisted pair or cable shall be tagged throughout the site with EZ Markers with the room number it serves. All conductors in terminal cabinets shall be carefully formed and harnessed in a workmanlike manner.

3.2 SYSTEM CABLING

All system cabling shall be installed in conduit except where wiring occurs above accessible ceilings. All wiring in walls shall be in conduit. All conduits shall be run concealed. Where architecture precludes concealed conduits, run conduits on top of beams or trusses and minimize the exposure to view.

3.3 CABLES INSTALLED WITHOUT RACEWAYS OR CABLE TRAY SUPPORTS

The portions of cables installed without raceways or cable tray supports shall be installed with “j-hook” cable supports.

A. The “j-hooks” shall provide multi-tiered “j” shaped hooks, with wide flat cable support base (0.5-inch wire minimum) and smooth rounded corners, specifically designed for Category-5/6 cable and fiber optic cable support. As manufactured by Erico Inc.

B. The individual "j-hook" attachment to the building structure shall be "beam clamp", "hanger rod", clevis hanger styles.

C. Install "j-hooks" not more than 48-inches on center along the entire cable length, at each cable change in direction, to insure less than 6-inches of cable sag between adjacent hooks. Secure cables to "j-hooks" with cable tie wraps. "J-hook" supported cables, bundle cables together with tie wraps not less than 12-inches on center along the entire cable length.

D. Each J-hook shall not support more than twelve individual cables. Provide multiple "tiered" J-hooks for additional cable quantities at each location.

E. "Bridle rings" shall NOT be used to support cables.

F. Cables shall not lie directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

3.4 MOTION SENSORS

Locate motion sensors to provide optimum coverage of the space and to avoid conflicts with the architectural aesthetics of the building. Submittal Drawings shall show the exact locations of all system sensors.

3.5 SYSTEM PROGRAMMING

Provide all system programming including the necessary product handlers so that all parameters are entered into the system and the annunciator displays a text, which is customized to the facility.

3.6 SYSTEM TESTING AND DOCUMENTATION

A. Before the Contract shall be considered complete, the Contractor shall program the system per District Requirements and demonstrate the performance of the system in the presence of the District. The Contractor shall provide all test and reception gear required to prove the performance as outlined.

B. When the testing has been completed to the satisfaction of both Contractor's Job Foreman and the Representatives of the Manufacturer and the DSA Inspector, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be provided by the Contractor and forwarded to the Architect.

END OF SECTION 283100
120123/1022037

SECTION 284620 - FIRE ALARM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
   1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26, 27 and 28.
   2. General Provisions and Requirements for electrical work.

B. This Specification provides the Minimum Requirements for the Fire Alarm and Detection System. The system shall include, but not limited to all equipment, materials, labor, documentation, and services necessary to furnish and install a complete, operational system inside the new modular building.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit copies of the following to the Architect for Approval.
   1. A listing of all fire alarm components and equipment including the California State Fire Marshal (CSFM) listing numbers.
   2. CSFM listing sheets for all devices being used.
   3. Manufacturers' standard catalog data for fire alarm components.
      a. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure.
      b. The Manufacturers' data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of item. The data sheet shall completely describe the proposed item.
      c. Where modification to the equipment is necessary to meet the Operational Requirements of the Contract Documents and the data sheets shall include complete Mechanical and Electrical Shop Drawings detailing the modification.
   4. A listing of the outlet rough-in needed for every device and equipment item. The applicable symbol which illustrates that rough-in item on the Job Plans shall be drawn on the proposal, opposite the description of the rough-in to facilitate locating the data by Field Personnel.
   5. Elevation and dimensional information.

1.3 APPLICABLE STANDARDS

The Equipment shall be listed, labeled, and approved for the application shown in Contract Documents, as fire alarm equipment complying with the Codes and Regulations indicated on the Drawings.

1.4 EQUIPMENT AND INSTALLING QUALIFICATIONS

A. The Equipment shall be exclusively as manufactured by companies indicated on the drawings in order to match existing fire alarm equipment on campus. No equals will be allowed.

B. The Specification is based on the equipment of Manufacturers who have been approved by the District and the Manufacturers herein named shall be considered as meeting the Requirements of this Specification. For all items which are identified by part number and Manufacturer the Performance Specifications which are published in the most recent Manufacturer's data sheets available at the time of bidding this Project shall be applicable to the present work as though fully written out herein.

C. All Equipment shall conform to all local applicable Codes and Ordinances and shall be listed by Underwriters Laboratories.

D. To Qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be qualified Fire Alarm Contractor and shall hold a valid C10 License issued by the Contractors State License Board of California. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction over the work. The Contractor shall be the Factory Authorized Distributor for the branch of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5 years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall be financially able to provide a performance bond covering the work and the guarantee described. The Contractor shall provide that bond if requested.

E. Installation Certification
   1. Work and material for cables, cable terminations and related components shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.
   2. The Manufacturers of the indicated work and material shall provide an Installer education/training and certification program for the supplied products.
   3. The Installers performing the Contract Work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.
   4. Submit six copies of the Manufacturer's Certifications for each Installer performing the work. The submittal shall be approved prior to initiating any related Contract Work.
   5. Contract material installed, and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall be done at the Contractors' expense, without any additional cost to the Contract and without any additional Contract completion due date extensions. New material and work required to replace the non-compiling removed work and material shall be provided at the Contractors' expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM OPERATION

A. System shall be microprocessor-based, addressable, and power-limited with Class B super-vised circuits, one-way and two-way emergency audio communications.

B. Alarm Conditions
   1. Sequence of operation under alarm conditions shall be as indicated in the Drawings.

C. Trouble Condition
   1. A single open or single trouble condition in a manual or automatic fire initiating wiring circuit shall activate the respective zone trouble lamp or annunciator readout on the fire alarm control panel and sound a trouble signal at the control panel.
   2. A single open or single trouble condition in the notification alarm signaling wiring circuit shall activate the trouble lamp or annunciator readout in the control panel and sound a trouble signal at the control panel.
   3. 120-volt AC normal power shall be monitored with indication by a "power on" lamp. Upon normal power outage, the system shall activate power trouble condition lamp or annunciator readout and indicate a trouble condition.
   4. The control panel shall monitor the standby batteries and, upon a low battery condition, activate the low battery lamp or annunciator readout and indicate a trouble condition.
   5. System ground detection shall be provided for the entire system. Upon ground detection, activate the ground detection lamp or annunciator readout and indicate a trouble condition.

2.2 AUTOMATIC ALARM INITIATING DEVICES

A. General
   1. An electronic digital, multiplex, addressable module shall be incorporated into each device. The module shall communicate the status and trouble condition of each device with a unique address code. The module shall communicate with and be supervised and monitored by the fire alarm control panel.
   2. Devices shall be suitable for use on a Class "B", 2-wire supervised alarm initiating circuit. Where initiating devices are shown connected to an existing system, devices shall operate on 2-wire or 4-wire circuits plus, 2-wire power circuit as required by the existing equipment.
   3. Numbered screw type terminals shall be provided for "in-out" connectors of the alarm circuit wiring.

B. Smoke Detector
   1. Detectors shall comply with UL Standard 268, 167 and 168. Detectors shall use solid state electronic circuits throughout.
   2. The smoke detector shall operate on a total of two circuit wires. Alarm signaling and detector power shall use the same conductors. Detector sensitivity shall be factory set at 1.5%. Provide testing provisions in accordance with CFC 907.9.3 – 907.9.4.1, NFPA72.
   3. A fine mesh insect screen shall be provided on all detector openings.
   4. The detector shall also incorporate a fixed temperature heat detector rated at 135 degrees F. The heat detector shall operate the alarm circuit and alarm/trouble light.
      a. Photo electric type smoke detectors shall employ a Light Emitting Diode (LED) as the detector light source, activated by the presence of combustion smoke products. Failure of the LED shall activate the alarm/trouble light on the detector.

C. Fire Detector - Heat
   1. Heat detectors shall be dual action electro-thermostatic combination rate of temperature rise and fixed temperature operation. An indicator shall be visible when detector has activated.
   2. The rate of rise element shall be self-restoring, after activation.
   3. The fixed temperature unit shall be set at 190 degrees F.
   4. Provide a wire guard cover for the detector.

2.3 NOTIFICATION ALARM DEVICES

A. General
   1. Notification alarm devices shall activate automatically from the control panel. Devices shall operate on a Class "B" (Style Y), 2-wire supervised alarm notification circuit. Series wired alarm devices shall not be used.
   2. Numbered screw type terminals shall be provided for "in-out" connections of the alarm circuit wiring.
   3. Devices shall be installed in a box, 3½-inches deep maximum, flush mounting unless indicated otherwise on the Drawings. Size as required for the alarm indicating device and wiring connections. Provide a trim ring and metal grill cover assembly. Cover assembly shall be a minimum of 1/16-inch minimum thick flat stainless steel or aluminum. Finish color as selected by Architect. The word "fire" shall appear on the grill minimum ½-inch letters. The grill shall be attached with screws to the box.

B. Notification Appliances
   1. Speakers-wall mount
      a. Provide low profile wall mount speakers at the locations shown on the Drawings. The low-profile speaker shall not extend more than 1-inch (2.5cm) past the finished wall surface and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), ½W (84dBA), or ¼W (81dBA) at 10 feet when measured in reverberation room per UL-464.
      b. Wattage setting shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low-profile speaker shall mount in a North American 4-inches x 2⅛-inches square electrical box, without trims or extension rings.
   2. Speaker-Ceiling Mount
      a. Provide 8-inches ceiling mounted speakers at the locations shown on the Drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square steel with white finish as required. Provide square surface mount boxes with matching finish where required. Speakers shall provide ½w, 1w, 2w, and 4W power taps for use with 70V systems. At the 4-watt setting, the speaker shall provide a 94-dBA sound output at a frequency of 1000Hz when measured in an anechoic chamber at 10 feet.
   3. Speaker-Reentrant Surface
      a. Provide 4-inch surface re-entrant speakers at the locations shown on the Drawings. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 70V systems. The re-entrant speakers shall utilize a high efficiency compression driver. Cone type drivers are not acceptable. At the 15-watt setting, the speaker shall provide a 102dBA sound output over a frequency range of 400-4000Hz when measured in reverberation room per UL-1480. Weatherproof boxes shall be provided for outdoor mounting.

4. Low Profile Wall Speaker-Strobe
   a. Provide low profile wall mount speaker/strobes at the locations shown on the Drawings. The low-profile speaker/strobe shall not extend more than 1-inch (2.5cm) past the finished wall surface and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), ½W (84dBA), or ¼W (81dBA) at 10-feet when measured in reverberation room per UL-464.
   b. Strobes shall provide synchronized flash output that shall be switch selectable for output values of 15cd, 30cd, 75cd and 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low-profile speaker/strobes shall mount in a North American 4-inches x 2⅛-inches square electrical box, without trims or extension rings.
5. Speaker-Strobe Ceiling 8-inches
   a. Provide 8-inches ceiling mounted speaker/strobes at the locations shown on the Drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide ½w, 1w, 2w, and 4W power taps for use with 70V systems. At the 4-watt setting, the speaker shall provide a 94 dBA sound output at a frequency of 1000Hz when measured in an anechoic chamber at 10 feet. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.

C. Visual Alarm Indicator
1. Lamp/Strobe internally illuminated projecting lens assembly, with flasher system. Unit shall flash on and off to provide visual indicating of fire alarm.
2. The word "fire" shall appear on the lens or lens plate.
3. Flash rate, one flash per second, with a flash duration of approximately 0.001 second, flash rate independent of audible device.
4. Light source, Xenon high intensity flash strobe tube white/clear color.
5. Strobe shall have flash intensity as indicated on plans.
6. Strobe shall comply with NFPA Requirements.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. The Inside Cover of alarm initiating devices shall be marked with the zone initiating number corresponding to the zone number in the control panel. Marking shall be with a felt-tip pen.

B. Fire Alarm Terminal Cabinet shall be painted red.

C. Provide Nameplate: "Power to Fire Alarm Panel" screwed onto the branch circuit overcurrent device supplying power to the main fire alarm control panel.

3.2 WIRING

A. Review the Total System Point-to-Point Wiring layout to assure that the correct number and type of wires and conduit sizes are installed.

B. Final Connections, Testing, Adjusting and Calibration shall be made under the direct supervision of a Factory-Trained Technician of the System Supplier.

C. All Wiring shall be in conduit.

D. All Wiring in Cabinets shall be neatly formed, laced and made up on bolt and nut terminal blocks. Tag all spare conductors. All conductors shall terminate on terminal strips with spade lugs, of adequate size for all incoming and outgoing conductors. The strips shall be labeled as to their use and a wiring diagram shall be placed on the cabinet door showing connections of all related equipment to these strips.

E. Wiring Requirements for Shielding Certain Conductors shall be as recommended by the Manufacturer. Provide all conduit, raceways and conductors per Manufacturers recommendations and include all material and labor costs in the Contract price.

F. The Conductors used for digital, multiplex communication between the fire alarm control panel and external remote initiation devices, control points and annunciators, shall be twisted, shielded, multi-conductor cable, #16AWG copper minimum with a separate internal ground/ drain conductor, UL listed for fire alarm system use. One spare pair of multiplex conductors shall be provided in all main and branch device/equipment connections for future system use. "Tees" and taps at any junction box location in the communication lines, shall be permitted by the system to additional devices without affecting proper system operation.

G. Wire Size: Wire shall be sized to insure installed circuit voltage drop does not exceed 10% to all devices.

3.3 OUTLET BOXES

Device Outlet Boxes shall be flush mounted unless indicated otherwise on the Drawings. Provide extension rings to finish flush with finish surface. Where the Drawings indicate surface mounted devices, outlet boxes shall be cast metal with threaded hubs. Where the conduit entrances are not exposed for surface mounted devices, provide flush outlet box behind the device box, and omit the conduit hubs on the device box. Size device boxes and outlet boxes per Manufacturer's recommendation and as required by Code for wire fills.

3.4 SPECIAL INSTALLATION REQUIREMENTS

A. Equipment shall be weatherproof gasketed where installed in locations exterior to the building, or where indicated on the Drawings. Weatherproof equipment shall be tamper-resistant.

B. Conduit with fire alarm wiring shall be painted red.

C. Reprogram the existing Fire Alarm Control Panel so that the new building is fully integrated into the existing system including the existing remote annunciator.

3.5 TESTING

A. All new fire alarm devices shall be tested in the presence of the local DSA Inspector and a Representative of the Manufacturer after the installation is complete.
   1. Individually test each automatic initiating device and verify correct alarm operation, control panel response and remote equipment operation.
   2. The communication loops and the notification alarm circuits should be opened in at least two locations per building to check for the presence of correct supervisory circuitry.

B. Test the Battery Back-Up System by disconnecting the incoming normal power and allowing this alarm system to operate 24 hours on battery power. Sound the alarm system for 15-minutes at the end of 24 hours on battery power.

C. Perform all Electrical and Mechanical Tests required by the Equipment Manufacturer's certification form. Measure and adjust each automatic detection detector to the maximum stable sensitivity setting. Detector tests shall be performed with the detector at its operational location and under normal operational environmental conditions in the area. Bench settings are not acceptable. An operational check-out test and report shall be performed. Submit six copies of the test report results. The tests and report shall include, but not be limited to:
   1. A complete list of equipment installed and wired.
   2. Indication that all equipment is properly installed and functions and conforms with these Specifications.
   3. Test of individual zones as applicable.
   4. Serial numbers of locations by zone and model number for each installed detector.
   5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
   6. Technician's name, certificate number and date.
   7. The completed manual and automatic monitoring and control system shall be tested to insure that it is operating properly. This test will consist of exposing the installed units to a standard fire test.

D. After the Testing has been completed to the satisfaction of CFC 907.9 – 907.9.4.1 the Inspectors, provide the NFPA Certificate of Compliance to the District, the local Fire Official, the Architect and DSA.

E. Upon receipt of Certificate of Compliance, the Installer/Supplier shall supply the District with a written operating, testing and maintenance instructions, Point-To-Point As-Built Drawings and Equipment Specifications. Maintenance provisions, CFC 907.4.5.

END OF SECTION 28 46 20

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting and capping or sealing site utilities.
7. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

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

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site-clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringen.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

3.5 CLEARING AND GRUBBING

A. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

B. Place fill material in horizontal layers not exceeding a loose depth of **[8 inches]** and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 312000 – EARTH MOVING SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

1.2 QUALITY ASSURANCE

Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC), latest edition and supplements for rock materials. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 REFERENCES

This specification section has been prepared using the project soils report "TK/PK Clasrooms & Early Learning Building Buena Park School District Carl E. Gilbert Elementary School 7255 8th" by Ninyo & Moore dated February 14,2024.

1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

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

F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

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

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Sand, gravel, friable earth, or non-expansive clays, subject to Testing Laboratory's approval. Fill and backfill material shall be free of organic material, slag, cinders, expansive soils, trash or rubble and stones having maximum dimension greater than 6 inches.

C. Unsatisfactory Soils: Expansive and other soils as defined in the project's geotechnical investigation report.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Base Course: Material conforming to SSPWC section 200-2.2, Crushed Aggregate Base or SSPWC section 200-2.4 Crushed Miscellaneous Base.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded clean, crushed sand; ASTM D 2940; except with 100 percent passing a 3/8-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility. Color coding shall be according to the American Public Works Association (APWA) standards:

1. Blue – Potable water and fire suppression lines.
2. Green – Sanitary sewer and storm drain lines
3. Orange – Communication, alarm or signal lines
4. Purple – Reclaimed water, irrigation, and slurry lines
5. Red – Electrical power lines, cables, conduit and lighting lines
6. Yellow – Gas, oil, steam, petroleum, or gaseous material lines.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing" or “Demolition”.

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing" or “Demolition,” during earthwork operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide 6 inch clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean

concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section Cast-in-Place Concrete.

D. Provide blanket protection for all utility pipes and conduits under driveways, roadways, parking lots, and other vehicular path of travel per APWA Standard Plan 225-1 where the minimum cover over the pipes and conduits is less than 36”.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, minimum 6 inches above top of pipe, minimum 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use engineered fill.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material to 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to 90 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material to 90 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 BASE COURSES

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Shape base course to required crown elevations and cross-slope grades.
2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.15 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 320120 - DETECTABLE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Raised truncated domes.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Detectable warning surfaces:
      a. Detectable warnings surfaces shall comply with CBC Section 11B-705.1.
      b. Detectable warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595C, except for locations at curb ramps, islands, or cut-through medians where color used shall contrast visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3.
      c. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. CBC Section 11B-705.1.1.4.
      d. Provide minimum 5 year warranty per DSA Bulletin 10/31/02, revised 04/09/08.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Samples: 5 by 5 inch sample.

C. Shop Drawings: Show fabrication details, composite structural system, joints, and material to be used as well as outlining installation materials and procedure.

D. Qualification Data: For manufacturer.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance requirements indicated, based on comprehensive testing of current materials.

F. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Duration: 5 years. Such warranty shall indicate compliance with architectural standards as published in the current edition of the California Building Standards Code, and also include durability criteria which indicate that the shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for specified years after initial installation.
   1. As used in this bulletin, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the enforcing agency.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Raised Truncated Domes: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Armorcast Products Company. (Basis of Design)
   2. Access Tile.
   3. Armor-Tile by Engineered Plastics Inc.
   4. ADA Tactile Systems.
   5. Or equal.

2.2 RAISED TRUNCATED DOMES

A. Surface applied system:
   1. Product: Model A6003648 by Armorcast Products Company.
   2. Compressive Strength: 11,430 PSI per ASTM C-170-99.
   3. Shear Strength: 11,670 PSI per ASTM D-372-02.
   4. Flexural Strength: 3,330 PSI per ASTM C-580-02.
   5. Modulus Elasticity: 1,776,400 PSI per ASTM C-580-02.
   6. Tensile Strength: 1,710 PSI per ASTM C-307-99.
   7. Chemical Resistance: Pass per ASTM D-543.
   8. Simulated Sunlight: Pass per ASTM D-1501.
   9. Accelerated Service Test: Pass per ASTM D-756.
   10. Water Absorption: <.1% per ASTM D-570.
   11. Flammability Test: Pass per ASTM D-635.
   12. Fungus Resistance Test: No Growth per ASTM G-21.
   13. Smoke Density: 0.3 (DS@1.5 Minutes) and 14 (DS@4 Minutes) per ASTM E-662-03.
   14. Color: Yellow.
   15. Installation: Flush install by pressing into wet concrete per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proceed with operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 INSTALLATION

A. Surface Applied System:
   1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
   2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
   3. Ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to the Architect.
   4. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. A thin permanent marker works well. Remove tile when done marking its location.
   5. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.
   6. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for a minimum of 30 days.
   7. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
   8. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2” width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.
   9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
   10. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3-1/2 inch using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.
   11. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.

12. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.
13. Working in a sequence which will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.
14. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2” from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.
15. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.

END OF SECTION 320120

SECTION 321216 - HOT-MIX ASPHALT (HMA) PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes hot-mix asphalt paving, patching, and paving overlay.

B. Traffic Stripes and Pavement Marking.
   1. traffic stripe: A longitudinal centerline or a longitudinal lane line used for separating traffic lanes in the same direction of travel or in the opposing direction of travel or a longitudinal edge line marking the edge of the traveled way or the edge of a lane at a gore area separating traffic at an exit or entrance ramp. A traffic stripe is a traffic line as shown.
   2. Pavement marking: A transverse marking such as (1) a limit line, (2) a stop line; or (3) a word, symbol, shoulder, parking stall, or railroad grade crossing marking.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Material certificates.

D. Log of placement of asphalt, including dates, times, temperature readings and other pertinent information.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

B. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work. These Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the atmospheric temperature is at least 50 deg F and rising at time of placement or during unsuitable weather.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at an ambient or surface temperature range recommended by the paint manufacturer.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate (Type III Asphalt Concrete Mixture): Conforming to SSPWC 203-6.2.3.

B. Fine Aggregate (Type III Asphalt Concrete Mixture): Conforming to SSPWC 203-6.2.3.

C. Mineral Filler: Conforming to SSPWC 203-6.2.4.

2.2 ASPHALT CONCRETE MIXTURE

A. Composition and Grading: Conforming to SSPWC Sections 203-1 and 203-6.5.

2.3 ASPHALT MATERIALS

A. Asphalt Binder: Paving asphalt, viscosity grade [PG 64-10] conforming to SSPWC 203-1.2.

B. Tack Coat: PG 64-10 conforming to SSPWC 302-5.4.

C. Mixes: Hot-Mix Asphalt (HMA):

Wearing Course: Dense, hot-laid, hot-mix asphalt plant mix III-C3, [PG 64-10] designed in conformance with SSPWC Section 203.

Base Course: Dense, hot laid, hot-mix asphalt plant mix III-B2, [PG 64-10] designed in conformance with SSPWC Section 203.

D. Fog Seal: CSS-1 conforming to SSPWC 203-3.

E. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

F. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952E for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01R2 for White, Yellow and Black paint) with drying time of less than 45 minutes.

1. Color: White, Yellow, and Blue as indicated on the plans.

G. Wheel Stops: Precast, air-entrained concrete.

1. Dowels: Galvanized steel, 3/4-inch diameter, 24-inch minimum length.

PART 3 - EXECUTION

3.1 ASPHALT CONCRETE AND ASPHALT CONCRETE PAVEMENT

A. All work shall be in conformance with SSPWC Sections 203-6 and 302-5.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 gallon per square yard or SS-1h emulsified asphalt at an approximately rate of 0.05 to 0.10 gallon per square yard.

C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 gallon per square yard.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3. Asphalt binder tack coat temperature must be in the range of 285 to 350 deg F when applied.

3.4 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Spread mix at minimum temperature of 285 deg F and maximum temperature of 350 deg F.
2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 FOG SEAL

A. Apply asphaltic emulsion for fog seal coat at a residual asphalt rate of 0.2 to 0.06 gal/sq yd.

B. Apply fog seal coat when the ambient temperature is above 40 degrees F.

C. At the time of application, the temperature of asphaltic emulsion must be from 130 to 180 degrees F.

D. Apply asphaltic emulsion when the ambient air temperature is from 65 to 110 degrees F and pavement surface is at least 80 degrees F.

E. Do not apply asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

F. When tested under California Test 339, the application rate for asphaltic emulsion must not vary from the average by more than:
   a. 15 percent in the traverse direction
   b. 10 percent in longitudinal direction

3.6 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Pave HMA in maximum 3" thick compacted layers.

2. Minimum atmospheric temperature shall be 55 deg F, and minimum surface temperature shall be 60 deg F. If the surface to be paved is both in sunlight and shade, pavement surface temperatures must be taken in the shade.

3. Complete compaction for Base Course before surface temperature drops below 250 deg F, and for Wearing Course before surface temperature drops below 150 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Wearing Course: Plus 1/4 inch (no minus).
3. Total Base Course plus Wearing Course shall not be less than specified thickness.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch
2. Wearing Course: 1/8 inch
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 PAVEMENT STRIPING AND MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age before starting pavement striping and marking, as recommended by the paint manufacturer.

C. Sweep and clean surface to eliminate loose material and dust in addition to recommended surface preparation by the paint manufacturer.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

E. Do not paint if the atmospheric temperature could drop below 50 deg F during the drying period.

3.9 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel 1 inch beneath top of wheel stop.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 321216

SECTION 321236 – Emulsified Slurry Seal

PART 1 - GENERAL

1.1 SUMMARY

A. The work shall consist of mixing asphaltic emulsion, aggregate, set-control additives and water, and spreading the mixture on a surfacing or pavement.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Asphaltic Emulsion: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Material certificates.

D. Log of slurry seal application, including dates, times, temperature readings and other pertinent information.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

B. Standard Specifications: Comply with latest editions and supplements for Caltrans Standard Specifications Sections 37 and 94. These Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: The slurry seal shall not be applied if either the pavement or air temperature is below 50 deg F. and falling, but may be applied when both pavement and air temperatures are above 45 deg. F and rising. No slurry seal shall be applied when there is a possibility of freezing temperatures at the project location within 24 hours after application.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 ASPHALTIC EMULSION

A. Asphaltic emulsion shall be a quick-setting type, grade QS1h anionic, or grade CQS1h cationic, conforming to the provisions in Caltrans Standard Specifications Section 94, Table 4. The grades of asphaltic emulsion shall be at the option of the Contractor.

2.2 AGGREGATE

A. Aggregate shall conform to the provisions in Caltrans Standard Specification Section 37-2.02C, Type **[I] [II] [III]**.

[**ENGINEER TO SPECIFY TYPE OF AGGREGATE MIX, AS PROJECT CONDITIONS WARRANT**]

Type I: This aggregate gradation is used to fill surface voids, address moderate surface distresses, and provide protection from the elements. The fineness of this mixture provides the ability for some crack penetration.
Type II: This aggregate gradation is used to fill surface voids, address more severe surface distresses, seal, and provide a durable wearing surface.
Type III: This aggregate gradation provides maximum skid resistance and an improved wearing surface.

2.3 WATER

A. Water shall be such quality that the asphalt will not separate from the emulsion before the slurry seal is in place in the work. If necessary for workability, a set-control agent that will not adversely affect the slurry seal may be used.

2.4 MIX DESIGN

A. Compatibility of the emulsified asphalt, aggregate, water and additives shall be evaluated in the mix design. The slurry seal mixture shall conform to the requirements specified when tested in accordance with the Caltrans Standard Specifications Section 37-2.03.

2.5 PAVEMENT MARKING PAINT

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.

1. Color: [**White**] [**Yellow**] [**Blue**] [**As indicated**] <**Insert color**>.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Prior to applying the slurry seal, loose material, oil spots, vegetation, and other objectionable material shall be removed. A standard cleaning method such as sweeping, flushing, or other means will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing. Manholes, valve boxes, catch basins, and other utility boxes shall be protected from slurry seal by a suitable method.

B. Treat cracks wider than 0.25 inches in the pavement surface with an approved crack sealer prior to application of slurry seal.

3.2 PLACING

A. The slurring mixture shall be uniformly spread on the existing surfacing within the rate specified without spotting, re-handling or otherwise shifting of the mixture.

B. Slurry seal shall not be placed when the atmospheric temperature is below 50 deg. F or during unsuitable weather.

C. Slurry seal shall be spread at a rate specified in Caltrans Standard Specifications Section 37-2.06.

D. The mixture shall be uniform and homogeneous after spreading on the existing surfacing and shall not show separation of the emulsion and aggregate after setting.

E. Lumping, balling, or unmixed aggregate will not be acceptable.

F. Adequate means shall be provided to protect slurry seal from damage by traffic until such time that the mixture has cured sufficiently so that the slurry seal will not adhere to and be picked up by the tires of vehicles.

G. No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or traverse joints. The contractor shall provide suitable equipment to produce a minimum number of longitudinal joints throughout the project. When possible, a longitudinal joint shall not be place in a wheel path. Less than full box width passes will be used only as required. If less than full box width passes are used, they shall not be the last pass of any paved area. A maximum of 6” shall be allowed for overlap of longitudinal joints.

H. Area which cannot be accessed by the mixing machine shall be surfaced using hand squeegees to provide complete and uniform coverage. If necessary, the area to be handworked shall be lightly dampened prior to mix placement. Handwork shall exhibit the same finish as that applied by the spreader and shall be completed prior to final surfacing.

I. Care shall be taken to apply straight lines along curbs and gutters. No run-off on these areas will be permitted. Roofing felt or heavy plastic may be used to begin or end a pull cleanly.

J. Rolling is not necessary for slurry seal on roadways. Parking areas shall be rolled by a self-propelled, 10-ton (maximum) pneumatic tire roller equipped with a water spray system. All tires shall be inflated per manufacture's specifications. Rolling shall not start until the slurry has cured sufficiently to avoid damage by the roller. Areas which require rolling shall receive a minimum of two full coverage passes.

3.3 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Remove and replace or install additional slurry seal mixture where test results or measurements indicate that it does not comply with specified requirements.

3.5 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 32 12 16

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including admixtures.

B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

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

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

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

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT –

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type II, low alkali. Supplement with the following:

a. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.

B. Combined Aggregates: Gradation “C” conforming to SSPWC Section 201-1.3.2.

C. Water: ASTM C 94/C 94M.

2.3 CURING MATERIALS

A. Liquid Curing Compound: ASTM C309, fugitive dye dissipating type, complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254.

B. Moisture-Retaining Cover (Curing Sheet): ASTM C 171, non-staining polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.4 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete.

1. Dowels: Galvanized steel, 3/4-inch diameter, 24-inch minimum length.

2.5 CONCRETE MIXTURES

A. Prepare design mixtures in conformance with SSPWS Section 201, with the following properties:

1. Concrete class: 560-C-3250.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45
3. Slump Limit: 4 inches**.**

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates to Architect for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 PORTLAND CONCRETE PAVEMENT

A. All work shall be in conformance with SSPWC Sections 201-1 and 302-6.

3.2 EXAMINATION

A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General: Form construction, isolation, and control joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed pavement surfaces with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing the concrete but not before free water has disappeared from the concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.9 PAVEMENT TOLERANCES

A. Comply with tolerances as follows

1. Elevation: 1/4 inch
2. Thickness: Plus 3/8 inch minus 1/4 inch
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust in addition to recommended surface preparation by the paint manufacturer.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

E. Do not paint if the atmospheric temperature could drop below 50 deg F during the drying period.

3.11 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel 1 inch beneath top of wheel stop.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321540 – GRANITECRETE – CRUSHED AGGEGATE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. CRUSHED AGGREGATE BLENDED WITH GRANITECRETE ADMIXTURE

B. COORDINATE WITH DRAWINGS: Show location and extent of stabilized aggregate surfacing. Show details required at adjoining materials and special conditions. The depth of base course and the thickness of stabilized aggregate surfacing can be either shown on the drawings or described in the specifications; edit this section carefully to avoid conflicting requirements.

C. FOR MORE INFORMATION: Contact GraniteCrete Incorporated, www.granitecrete.com, email info@granitecrete.com , or call (800) 670-0849.

D. Section Includes: Crushed aggregate blended with GraniteCrete admixture surfacing

E. Related Work:
Section – Earth Moving [fill in here]: Grading
Section – Base Courses [type]: Base Course

1.2 REFERENCES

A. ASTM C136-Sieve Analysis of Fine and Coarse Aggregates

B. ASTM D2419- Sand Equivalent Value of Soils and Fine Aggregates

C. Caltrans Standard Specifications for Public Works Construction

D. RIS-Redwood Inspection Services Grades of California Redwood

1.3 SEQUENCING

A. Do not install work specified in this section prior to acceptance of earth moving. Coordinate work specified in this section with work specified in other sections to minimize cutting of - and operation of - heavy equipment over newly-installed surfacing.

B. Submit in accordance with Section - Submittal Procedures

1) Manufacturer’s product data sheet and installation instructions indicating that product complies with specifications for:

a. Crushed aggregate blended with GraniteCrete admixture surfacing
b. Edging per plan.

2) Submit a quart jar size sample[s] of crushed aggregate with admixture in color[s]

specified on the plan.

1.4 QUALITY ASSURANCE/FIELD QUALITY CONTROL

A. GraniteCrete Approved Installers can be found on our website here:

Professional Installation.

1. Installations 500 square feet and over up to 3,000 square feet – must be a recommended installer at a minimum. Installations 3,000 square feet and over – must be an Approved Installer.

2. An installer not approved, but with sufficient experience for the project as determined by Granitecrete, Inc., may fulfill this requirement by providing a current letter from Granitecrete, Inc. verifying their ability to complete a successful installation for this specific project. For assistance, contact GraniteCrete, Inc. at (800) 670-0849.

3. For installations 3,000 square feet and over - if the installer is not approved as noted above, GraniteCrete, Inc. requires a mandatory Pre-Construction Meeting on site with the company representative. The installers, foreman,and supervisor managing the installation are required to attend the meeting.

4. A representative from GraniteCrete, Inc. will also observe the installation on-site until the company feels confident the installer will successfully install the product to their specifications and satisfaction.

5. The installation instructions in this Specification are meant as a guide for bidding purposes and will be superseded by the approved Submittal of installation instructions from GraniteCrete, Inc., and any field direction provided by the company representative.

6. GraniteCrete, Inc. does not offer a warranty on any installation - even if completed by an Approved Installer - only on the product, bag-to-bag.

B. Porous Base Rock Testing:

1. Testing shall occur during installation at [ ] ton increments of shipping for sieve conformance. Results shall be submitted prior to completion of the stone base installation.

    a. The stone field area shall have a permeable rate no less than 14” per hour. The testing shall be per Din 8035 Part 7, ASTM 2434 (constant head), or ASTM F2898 testing methods.

    b. In addition to the lab testing, after installation of any aggregate base cross-section, designed to conduct rainfall to the sub-soils and/or under-drain system, the finished aggregate base shall be tested, in situ for infiltration rate, using method ASTM F2898. The test shall be performed by a registered Geotechnical Engineer or certified agronomist.

2. The Contractor is responsible to meet this performance specification, before proceeding with installation, and shall bear the cost of the on-site testing and the cost of any additional work necessary to achieve compliance with the specification.

3. All test results shall be logged and documented by the Owner's Technical Representative or Geotechnical Engineer. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his expense, the processed stone base to the required grade, cross-section and density.

4. After the contractor has independently confirmed compliance with all the above tolerances (planarity and elevation verified by a licensed surveyor and compaction, gradation, & permeability verified by Geotechnical Engineer, he shall notify the appropriate party and schedule a final inspection for approval.

   The contractor shall make available an orbital laser system to the Inspection Team for the inspection process.

5. The compaction rate for porous base rock should be 88%. The compaction rate for non-porous base rock should be 95%.

C. Standard Specifications: Shall mean the California Department of Transportation Standard Specifications, latest active edition.

1.5 MOCK-UP

A. Construct mockup of [ ] square feet minimum of crushed aggregate blended with GraniteCrete admixture surfacing, including [base course and] edging, at location approved by [Architect] [Engineer] [Owner's Representative]. Build mockup [ ] days prior to installation. Intent of the mockup is to demonstrate surface finish, texture, color and standard of workmanship

B. Notify [Architect] [Engineer] [Owner's Representative] [ ] days in advance of mockup construction.

C. Allow [Architect] [Engineer] [Owner's Representative] to view and obtain approval of mock-up before proceeding with rest of crushed aggregate blended with GraniteCrete admixture surfacing.

D. [Approved mock-up may remain as first in place construction] [Remove mock-up after acceptance of work specified in this Section.]

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all GraniteCrete Admixture [bags] [bulk] materials in original, unopened packaging. Protect materials and aggregate from contamination with foreign matter. Store under waterproof cover and protect from dampness.

1.7 FIELD CONDITIONS

A. Do not install crushed aggregate blended with GraniteCrete admixture surfacing when sub-base is wet at saturated field capacity.

B. Do not install GraniteCrete materials during rainy conditions or below 40 degrees Fahrenheit.

PART 2: PRODUCTS

2.1 CRUSHED AGGREGATE BLENDED WITH GRANITECRETE ADMIXTURE SURFACING MATERIALS.

A. Acceptance Manufacturer:

1. Specification is based on products by GraniteCrete, Inc.
   419 Webster Street, Suite 202
   Monterey, CA 93940
   Phone: (800) 670-0849; Fax: (800) 670-0849
   www.granitecrete.com

   GraniteCrete admixture is an all-natural product and does not contain oils, polymers, resins, or enzymes.

2. Substitutions: Not allowed.
3. Instructions to Bidders. Must be installed by a certified installer.

B. Decomposed Granite (DG), crushed aggregate.

1. DG shall have a 3/8" maximum gradation, produced from naturally friable rock/granite with enough fines to produce a smooth walking surface. Materials should be free from clay lumps, organic matter, and deleterious material. Blends of coarse sand and rock dust are not acceptable.

2. Use a single supply source for the entire quantity required.

3. Gradation, in accordance with ASTM C136:

4. Color: Should have gold to yellow hues. To be selected by [Architect] [Engineer] from manufacturer's standard colors.

5. Supplier: Vineyard Rock Products, Hollister, CA. - (831) 637-6443[Or equal].

C. Aggregate binder: Provide GraniteCrete Admixture. Color: Carmel Coast

2.2 BASE COURSE MATERIAL

A. Class II Permeable Base Rock.

B. Soft stone materials (i.e. sandstone, limestone and shale materials) are not suitable. Stone supplier shall certify that all supplied stone will be clean of this type of stone. All types of stone shall meet the following stability requirements.

TEST METHOD	CRITERIA
LA Abrasion (Calif. Test 211)	Not to exceed 40
Durability Index (Calif. Test 229)	Not less than 40

In addition, if stone stability to water and vehicles is in question, Owner has the right to perform additional testing to ensure material shall adhere to requirements of Caltrans Section 68, as well as additional applicable ASTM tests.

C. All testing fees shall be paid for by the Contractor.

D. Permeable Stone: Stone base materials shall be washed, 100% fractured, by mechanical means, with elongated characters on each individual particle larger than 1/4". Materials shall be devoid of mineral fines. All particles smaller than 1/4" shall be produced by manufactured means only. Rounded sands or aggregates are prohibited.

E. Delivery Moisture Content: Processed stone shall contain 90% to 110% of the optimum moisture content to ensure that fines do not migrate in transit or during placement and to facilitate proper compaction. The contractor shall ensure that aggregate leaving the source plant meets this requirement. The contractor is required to apply water to the processed stone on site to attain and maintain this minimum moisture content.

F. Aggregate or aggregate blends of permeable stone shall conform to the following gradation (please note this is for base rock, not for GraniteCrete):

SIEVE	**Sieve Sizes Metric (mm)**	**Percent Passing by Weight* Intended Result**	**Range**
1"	25.0	100	100
3/4"	19.0	100	90-100
3/8"	9.52	78	40-100
No. 4	4.75	36	25-40
No. 8	2.36	26	18-33
No. 30	0.600	11	5-15
No. 50	0.300	6	2-10
No. 200	0.075	2	0-5
Durability Index (CTM# 229)		40 min	
Sand Equivalent (CTM# 217)		70	
LA Rattler (CTM# 211)		500 Revs, less than or = 40%	

* AASHTO Test Method T-27

G. Specs for ⅜" minus and ¾" minus Crushed Aggregate Following ASTM D 1140-17:
100% fractured on all sides with no rounded particles
Sieve 200 - Non-expansive Clay Fines - not to exceed 18%

The below test is for ⅜" minus stone, at approximately 90% compaction when tested.

GraniteCrete Sieve Analysis
Cumulative Percent Passing

Sieve Size	% Passing	Sieve Ranges
1/2"	100	100
3/8"	95	98
#4	85	90
#8	75	85
#16	55	70
#30	38	57
#50	24	33
#100	15	24
#200	9	18
#400	0	9

2.3 ACCESSORIES

A. Water: Free from contaminants that would discolor or be deleterious to crushed aggregate blended with GraniteCrete admixture surfacing.

Installation: Do not use a vibratory plate to compact the GraniteCrete. Use a lawn roller filled with water to compact the GraniteCrete. Use a 36" drum roller or walk-behind roller in static position for driveways and larger installations. It is highly recommended to use a volumetric truck for driveways and larger installations; if possible, the use of a paver is highly recommended as well.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine grading and subsoil conditions. Do not proceed until conditions are acceptable.

3.2 PREPARATION

A. Excavation: Excavate to depth required so edges of crushed aggregate blended with GraniteCrete admixture surfacing will match adjacent grades and have a maximum cross slope of 1 percent. [Remove excavated soil from site.]

B. Sub-grade Preparation: Comply with Caltrans Standard Specifications Section 301-1 – "Sub-grade Preparation."

C. Base Course Installation: Class II permeable base rock at 90% compaction.

D. Edging: Install flush with crushed aggregate blended with GraniteCrete admixture.

3.3 INSTALLATION: There are two installation methods for GraniteCrete: "Dry" and "Wet." The dry method is for installations up to 500 square feet (most home applications).

The wet method is for installations over 500 square feet (most large, commercial installations) and may require the use of a volumetric truck.

GRANITECRETE INSTALLATION – GENERAL

A. Mixing method:

1. Installations less than 500 square feet may be mixed on-site.

2. Installations 500 square feet and over up to 3,000 square feet, must be delivered pre-mixed to the site from a GraniteCrete Inc. approved pre-mix facility. Approved retailers and pre-mix facilities can be found on the company website www.granitecrete.com.

3. Installations 3,000 square feet and over up to 5,000 square feet must be supplied by an approved pre-mix facility; GraniteCrete Inc. recommends the use of a volumetric truck.

4. Installations over 5,000 square feet require the use of a volumetric truck.

5. The volumetric truck must be calibrated for the GraniteCrete mixture. Contact GraniteCrete, Inc. at (800) 670-0849 for a list of approved volumetric truck operators.

The following installation instructions have been developed to help ensure a blemish-free, high-quality installation. While GraniteCrete looks similar to concrete, the installation of GraniteCrete follows a different procedure. For best results, follow the instructions below carefully.

For assistance, contact GraniteCrete, Inc. at 800-670-0849.

Installation Depth (also known as “lift”) For residential/pedestrian applications, GraniteCrete is installed as a 3-inch thick layer (“lift”) over a 4-inch subgrade of compacted Class II base rock. For commercial/light vehicular applications such as driveways, bicycle paths and cart paths, GraniteCrete is installed as a 4-inch thick layer (lift) over a 6-inch subgrade of compacted Class II base rock. Compaction rates for all applications are 88%–92%.

Please note: GraniteCrete compacts approximately ¼” per 1” of lift.

An online calculator to assist you with estimating the amount of material needed to complete your project can be found on the GraniteCrete website here: https://www.granitecrete.com/paving-materials-estimator/ Please note this is only an estimator and GraniteCrete, Inc is not responsible for the quantity of materials at the job-site.

GraniteCrete:
Residential/Pedestrian Application - (2 bag mixture) One cubic yard of aggregate/decomposed granite and two (85 lbs) sacks of GraniteCrete admixture combined covers 108 square feet at a 3-inch thickness. Note: Aggregate/decomposed granite should be 3/8” minus material and follow our sieve percentages in this Specification Guide within a +/- 5% range.
Commercial /Light Vehicular Application - (3 bag mixture) One cubic yard of aggregate/decomposed granite and three (85 lbs.) sacks of GraniteCrete admixture combined covers 82 square feet at a 4-inch

thickness. Note: Aggregate/decomposed granite should be 3/8” minus material and follow our sieve percentages in this Specification Guide within a +/- 5% range.

Class II Base Rock:
Residential/Pedestrian Application - After final compaction, baserock should have a 4-inch depth.
Commercial/Light Vehicular Application - After final compaction, baserock should have a 6-inch depth.

Mixing Ratios GraniteCrete:
Residential/Pedestrian Application – (2 bag mixture) The aggregate/decomposed granite (DG) is mixed with GraniteCrete admixture at a 19:1 ratio (19 units of DG to 1 unit of GraniteCrete, measured in volume).
Commercial/Light Vehicular Application - (3 bag mixture) The ratio for commercial applications is 12.5:1 (12.5 units of decomposed granite to 1 unit of GraniteCrete, measured in volume).

Installation Instructions - “Dry” Method

1. Class II Base Rock: Moisten and compact base rock on the entire installation area to an even depth of 4-inch or 6-inch, depending on residential or commercial application. A vibratory plate can be used to compact the base rock; it should not be used to compact the GraniteCrete for residential installations.

2. GraniteCrete: Wheelbarrow the prepared GraniteCrete/DG mixture to the installation site and place a layer of the mixture to one-half of the desired final lift. Be sure to spread the mixture out before proceeding to step 3; this will ensure the mixture is moistened and mixed thoroughly.

3. Moisten the material with a hose end trigger sprayer attachment, avoiding puddling – oversaturation is detrimental and will negatively affect the integrity of the finished product. Rake area lightly to evenly distribute water throughout the mix or "lift". Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners.

4. Install a second lift as above; when doing this, make sure to pay particular attention to the edges to ensure even material height, and moisten to dampen mixture.

5. Moisten until both lifts are damp. Proper moisture content can be checked by clenching your fist around the GraniteCrete, when the mixture just stays together and the color just starts to transfer to your hand, GraniteCrete is ready to compact.

6. Compaction: After proper moisture is achieved for compaction, hand tamp (with a 10” hand tamp) around benches, sign posts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.

7. Make several passes with a 36” lawn roller (filled with water), or for larger installations, a 36” walk-behind or drum roller in static position. Hand tamp out any imperfections with a 6” wooden masonry float.

8. Make sure to keep your 10” hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match existing finish.

9. When laying GraniteCrete in batches, be sure to use the cold joint method below to ensure a blemish-free installation.

10. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a me dium-bristled push broom. Then make several more passes with the lawn roller until the desired surface texture is achieved. With larger installations, a roller in a static position can be used, making sure to keep the drum clean at all times. Remove spoils off the surface.

11. DO NOT ALLOW GRANITECRETE TO DRY DURING INSTALLATION. MIST LIGHTLY WITH A HOSE END SPRAY HEAD AS NECESSARY OR COVER WITH A PLASTIC TARP.

12. The final step for a GraniteCrete installation is a dampening with water of all newly-installed and compacted GraniteCrete materials. Using a shower head/spray hose attachment, moisten the entire newly-installed GraniteCrete area - avoid puddling. For best results, moisten all newly-installed GraniteCrete paving a second time the following 1 to 5 days, as practical. Slow curing of GraniteCrete is important to avoid cracking. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.

Installation Instructions - “Wet” Method

After DG and GraniteCrete have been mixed together but BEFORE installation has begun: Mix thoroughly and moisten with water until the GraniteCrete mixture begins to marble or clump together. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it’s ready for installation.

1. Class II Base Rock: Moisten and compact base rock on entire installation area to an even depth of 4-inch or 6-inch, depending on residential or commercial application. A vibratory plate can be used to compact the base rock; it should not be used to compact the GraniteCrete for residential installations.

2. GraniteCrete: Wheelbarrow the prepared GraniteCrete/DG to the installation site and spread the mixture over the compacted base rock.

3. Compaction: Walking on the area is perfectly acceptable; initial compaction can be per formed by walking on the edges and corners. Rake or grade area with the flat side of a landscape or asphalt rake (Do not use tang side), until the GraniteCrete is one inch above finish grade.

4. Once initial compaction has been completed, hand tamp (with a 10” hand tamp) around benches, sign posts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.

5. Make several passes with a 36” lawn roller (filled with water), or for larger installations, a 36” walk-behind or riding-roller in static position. Hand tamp out any imperfections with a 6” wooden masonry float.

6. Make sure to keep your 10” hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match existing finish.

7. When laying GraniteCrete in batches, be sure to use the cold joint method below to ensure a blemish-free installation.

8. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a me dium-bristled push broom. Then make several more passes with the lawn roller until the desired surface texture is achieved. With larger installations, a roller in a static position can be used, making sure to keep drum clean at all times. Remove spoils off the surface.

9. DO NOT ALLOW GRANITECRETE TO DRY. MIST LIGHTLY WITH A HOSE END SPRAY HEAD AS NECESSARY OR COVER WITH A PLASTIC TARP.

10. The final step for a GraniteCrete installation is a dampening with water of all newly-installed and compacted GraniteCrete materials. Using a shower head/spray hose attachment, moisten the entire newly-installed GraniteCrete area - avoid puddling. For best results, moisten all newly-installed GraniteCrete paving a second time the following 1 to 5 days, as practical. Slow curing of GraniteCrete is important to avoid cracking. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.

The following information is applicable to BOTH installation methods. You may walk on GraniteCrete immediately after installation. However, like concrete, GraniteCrete gets stronger with time. Ideally, stay off the newly-installed GraniteCrete areas for at least one day; after that, foot traffic is allowed. Vehicular traffic should avoid newly installed areas for 5 – 7 days. Newly installed GraniteCrete paving surfaces are fully cured in 28 days. At that time, the entire surface should be blown or swept off to eliminate loose surface materials. Minor cracking may take place. However, over time, the aggregate fines will fill in the minor cracks and they should disappear. Occasional blowing off of the surface will help to minimize loose surface materials.

Cold Joint Methods: Cold joints can be used at the end of the work day.
Method One:

1. “Between pours,” stop at an area that makes the joint location look intentional. Take a chalk snap line just back from loose GraniteCrete into the compacted area and create a chalk line. Use either a masonry blade - or a square-nose shovel - and cut a straight line across the installation.

2. Continue with installation: Dampen the prior installation area. Place newly mixed Granite Crete into the area, being careful not to overlap existing compacted material. Place a three foot length of 2"x4" carefully along the edge of the new pour and compact by hitting/tapping the board with a single jack. Then, take a medium-bristled push broom and very lightly "feather" the two pours together.

Method Two:

1. Place a 2”X4” or 2”X6” piece of wood across the installation, loosely stake it, and finish compacting the material. Leave the board in place overnight.

2. The next day, carefully lift the wood up and away from the installed GraniteCrete. Continue the installation process as per step 2 under Method One, making sure to dampen the prior installation area.

Method Three: (Suggested for large open edges at the end of the work day)

1. Install steel edging at a location that looks "intentional" and aesthetically "makes sense." Per manently install using the stakes provided. Completely finish the first day's work.

2. The next day, simply continue with the installation. Make sure to dampen the prior installation area first. Leave the edging in place. Again, being careful not to leave any new material on the previously installed GraniteCrete.

Installing for Vehicular Traffic
Installing for vehicular traffic is nearly identical to the method above, EXCEPT you will use a vibratory plate or static riding roller to compact the GraniteCrete, after final compaction by a lawn roller. Please be aware the vibratory plate should be used carefully, as it can have negative effects on the GraniteCrete. Make sure to keep the plate clean. If any ridges or ruts occur, fill in with a hand tamp, compact, and broom over it as the finishing instructions above.

Recommended Equipment	**Tools Materials**
(3) Rounded point or flat edge shovels for moving product	GraniteCrete Admixture bags (85 lbs.)
6 cubic foot cement mixer for mixing small installations	3/8" minus aggregate/ decomposed granite
Wheelbarrow for moving material	Class II Base Rock or Class II Permeable Base
8" or 10" hand-tamps for compacting edges and corners, step back fills, and small areas	Curbing or Header Board materials (if desired)
Hose with a shower spray nozzle for moistening dry product	Water source
Landscape and asphalt rake with flat edge for finish grading	
Heavy lawn roller filled with water to compact	
Medium bristled push broom for finishing	
(2-3) 6″-9″ wooden masonry float for finishing (1) 6″-9″ steel float for cleaning hand tamp and roller	

A large commercial project may require the use of a volumetric concrete truck.

Please refer to our website for further information: https://www.granitecrete.com/installation/

3.4 Important Notes:

A. Do not allow GraniteCrete to dry during installation. Mist lightly with a hose end spray head as necessary - avoid puddling - or cover with plastic tarp.

B. Non-compacted - or poorly-compacted - GraniteCrete top layer will result in loose and pebbled materials. Edge and corner compaction may require special attention with a hand tamp during installation.

C. Non-compacted - or poorly-compacted - base rock may result in failure of the top layer of GraniteCrete.

D. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it's ready for installation. Excessive moisture level may result in "sticky" materials complicating the quality of the finish surface or proper compaction – if you squeeze the mixture and water oozes out, it is too damp. If the material is too wet, it may be placed on the bottom of the installation, with material that has a better moisture content on top.

E. Aggregate/decomposed granite materials should meet the sieve specifications in this Specification Guide

F. Surface shall follow overall contours of landscape. Flat areas shall be [sloped] [crowned] for drainage. Slope [2.0%] [ ] percent minimum to drain away from structures.

G. Compaction rates for all applications are 88% – 92%.

H. Please Note: 3/8" minus aggregate comes in different colors. GraniteCrete™ samples reflect the use of a Golden Granite decomposed aggregates.. Mock-ups using your local aggregate source is strongly suggested.

I. Saw cut expansion joints every 5' in narrower paths, every 12' in wider paths, and at every engineered stress areas. Wait 48 hours before saw cutting.

J. Cover finished surface, when practical, to achieve maximum curing period. See Section 3.5.

K. Minimum Compacted Thickness (See Section Details):
1. Residential/Pedestrian Paths: 3 inches.
2. Commercial/Light Vehicular Drives: 4 inches.

L. Completed, finished surface shall be of consistent quality and free of deleterious materi als such as organic materials, nails, stones, and loose material. Surface shall not have depressions or humps greater than [1/4] [ ] inch in ten feet. Cold joints, if any, should be inconspicuous.

3.5 PERIOD / PROTECTION

A. For Driveway Installations ONLY: Do not allow traffic on crushed aggregate blended with GraniteCrete admixture surfacing for 5 days after placement or until compacted crushed aggregate blended with GraniteCrete admixture surfacing has fully cured. [Cover for extended curing period].

B. Protect crushed aggregate blended with GraniteCrete admixture surfacing from damage until project completion. [Repair damaged areas to match specified requirements].

3.6 MAINTENANCE & REPAIRS

A. Follow manufacturer's recommendations.

B. Maintenance: Depending on the end users desired finish surface, maintenance may re quire occasional blowing off or brooming of paved surface - DO NOT use a pressure washer to clean GraniteCrete. Depending on quality of compaction at time of installation, a thin veneer of loose aggregate material is typical after the full 28 days cure period. If cracking appears in a GraniteCrete surface, broom loose aggregate "fines" into cracks and compact with a rubber mallet.

C. Repair: When repairing GraniteCrete it is important to use the original aggregate/ decomposed granite and the original GraniteCrete Admixture color to match previously installed materials. If the paved surface has large areas of raveled material (loose aggregate/decomposed granite) the initial installation may not have been properly compacted, or blended materials did not have optimum moisture content during installation. GraniteCrete must not be allowed to dry prior to final compaction. The following are suggestions for repair of raveled materials:

1. For the large loose areas, a minimum of a 3-inch of GraniteCrete can be installed. The repair areas need to be saw-cut at agreed length, removed, and re-installed. A portable concrete mixer or wheelbarrow can be used.

2. In areas that collapse/fail due to equipment weight, re-form and re-install with original materials as per specifications.

3. Cracks: Repair by brooming existing surface fines into the cracks of filling with dry, pre-mixed materials, or both. The onsite aggregate/decomposed granite should be sieved to 1/8" minus material for better application and in-fill of cracks. Materials should be mixed as per ratio described above. Broom or fill the crack, moisten, compact (with rubber mallet or hand compaction plate) and "feather" material into the final finish. This process might have to be done two or three times.

END OF SECTION

SECTION 32 18 16.13 PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 SCOPE

A. Furnish labor, material, and equipment necessary to install the poured-in-place, resilient surfacing system as shown on the drawings and specified herein.

a. Work shall include, but not be limited to the following: layout; excavation; backfill; furnishing and installing of base material; furnishing and installing of poured-in-place, resilient surfacing and all other incidental work to provide a complete resilient surfacing system.

b. Poured in place playground surfacing shall consist of a polyurethane binder mixed with recycled rubber, which will make up the Cushion Layer. The Cushion Layer is capped with EPDM, TPV or Treated SBR rubber granules mixed with a polyurethane binder creating the Wear Course. Surfaces shall comply with ADA and CPSC guidelines as well as ASTM Standards. Manufacture is to be certified by IPEMA, a third-party testing organization for playground surfaces and equipment.

1.2 PERFORMANCE REQUIREMENTS

A. Area Safety: Poured in place within playground use zones shall meet or exceed the performance requirements of the CPSC, ADA and Fall Height Test ASTM F1292-18. The surface must yield both a peak deceleration of no more than 200 G-max and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible portion of play equipment being installed as shown on drawings. IPEMA certification is required. (ASTM F1292-18 section 4.3.3: The laboratory test used to determine critical fall height shall have been conducted on surfacing material samples identical in design, materials, components, and thickness and manufactured as the installed playground surface).

B. Testing: NOTE: Critical Fall Height of Five (5), Six (6) and Eight (8) feet have been tested in accordance with Section 15 – Critical Fall Height Test Procedure of ASTM F1292-18.

C. Accessibility: NOTE: Children’s outdoor play areas shall be in compliance with the Uniform Federal Accessibility Standards (UFAS) FED-STD-795 and the Architectural and Engineer Instructions (9AEI) Design Criteria.

D. The requirements of the Americans with Disabilities Act. Accessibility Guidelines (ADAAG) 28 CFR Part 36 that provide equal or greater accessibility than the requirements of UFAS must also be met in children's outdoor play areas.

E. Poured in place surfaces intended to serve as accessible paths of travel for persons with disabilities shall be firm, stable and slip resistant, and shall meet the requirements of ASTM F 1951-14 and ASTM F1292-18.

1.3 APPLICABLE STANDARDS

A. ASTM International

B. ASTM C1028 - Standard test method for determining the static coefficient of friction of ceramic tile and other like surfaces by the horizontal dynamometer pull meter method. This standard replaces ASTM D2047.

C. ASTM D412 – Standard test methods for vulcanized rubber and thermoplastic rubbers and thermoplastic elastomers-tension.

D. ASTM D624 - Standard test method for tear strength of conventional vulcanized rubber and thermoplastic elastomers.

E. ASTM D2859 – Standard test method for flammability of finished textile floor covering materials.

F. ASTM E303 – Standard test method for measuring surfacing frictional properties using the British Pendulum tester.

G. ASTM F1292-18 – Standard specification for impact attenuation of surface systems under and around playground equipment.

H. ASTM F1951 – Standard specification for determination of accessibility of surface systems under and around playground equipment.

1.4 Poured in place surfaces shall be manufactured and installed by trained, experienced company employees or certified installers who have successfully completed the "Certified Installers Training Program" required by TotTurf.

1.5 Submittals: The following shall be submitted:

A. The Contractor shall submit, five (5) complete sets of the material submittals, including

manufacturer's name and address, specific trade names, catalog and model numbers, illustrations and descriptive material, and samples of the proposed material for this project clearly marked as to proposed items for approval by the Owner's representative.

B. Products submitted as equal must include hard copies of manufactures written specifications and warranty.

C. Manufacturer's descriptive data and installation instructions.

D. Manufacturer's details showing depths of Wear Course and sub-base materials, anchoring systems and edge details.

E. Upon request, a listing of at least five installations where products similar to these proposed for use have been installed and have been in service for a minimum period of 3 years. The list shall include owner or purchaser, address of installation, date of installation, contact person, and phone number.

F. A signed statement by an authorized official certifying that the surfacing system meets the requirements of ASTM F1292-18 for a head-first fall from the highest accessible portion of the specified playground equipment.

G. A signed statement from the manufacturer of the poured in place surfacing attesting that all materials under this section shall be installed only by the Manufacturer's Trained Installers.

H. A Certificate of Insurance shall be provided by manufacturer for poured in place surfacing for use as playground safety surfacing, covering general and product liability, of not less than $1,000,000 for each occurrence, $2,000,000 general aggregate, with an excess/umbrella liability of $25,000,000. The issuing underwrite shall be AA rated.

I. **IPEMA Certification mandatory**

1.6 Delivery, Storage and Handling: Materials and equipment shall be delivered and stored in accordance with the manufacturer's recommendations.

1.7 Project Site Conditions: Poured in Place surfacing must be installed on a dry sub-surface, with no prospect of rain within the initial drying period, and within the recommend temperature range of the manufacturer. Installation in weather condition of extreme heat, cold (less than 55 degrees F), and/or high humidity may affect cure time, and the structural integrity of the final product. Immediate surrounding sites must be reasonably free of dust conditions or this could affect the final surface look.

1.8 Sequencing and Scheduling: Poured in Place surfacing shall be installed after all playground equipment, shade structures, signs and any other items that will be within the surfacing area. Coordinate with General Contractor.

1.9 Surface installation coordinated by manufacturer representative.

1.10 Warranty: Poured in Place surface shall maintain required impact attenuation characteristics and be guaranteed against defects in workmanship AND material for a limited five (5) year period or as specified and agreed upon per alternate contract. Warranty will be specific to maintenance requirements and performance standards of completed product. Warranty is Void if not installed by Manufacturers Trained and Certified Poured in Place Surfacing Installers.

PART 2 – PRODUCTS

2.1 Safety surfacing shall consist of both recycled and synthetic materials meeting the requirements of this specification. The type of safety surfacing shall be TotTurf, manufactured and installed by TotTurf, or it's Certified Installers. Telephone (800) 858-0519.

2.2 PRODUCT SCOPE

A. Poured in Place Surface: The poured in place surface shall consist of recycled rubber mixed with a polyurethane binder, then capped with either an EPDM, TPV an aliphatic binder or aromatic binder.

B. It shall consist of a uniform material manufactured in such a way that the top portion meets the requirements specified herein for wear surface.

C. The type of safety surfacing shall be a poured-in-place system and shall be indicated on the drawings.

2.3 CUSHION LAYER SECTION

A. Impact Attenuation Cushion Layer consists of these materials; recycled styrene butadiene rubber (SBR) and/or Cryogenic crumb rubber and/or Chunk Premium Black Rubber Granules adhered with a 100 percent solids polyurethane binder to form a resilient porous material.

B. Strands of SBR may vary from 0.5 mm – 2.0 mm in thickness by 3.0 mm – 20 mm in length.

C. Chunk Premium Black Rubber Granules are 5/8” granules: This rubber is pre-consumer, post-industrial, reclaimed rubber, granulated through a 5/8” screen and contains less than 2% dust.

D. SBR Crumb Rubber (5-9 Mesh) using sieve analysis ASTM D5644 with a fiber content of .1% or less mixed in.

E. Binder shall be between 7-12% percent of the total weight of the material and shall provide 100 percent coating of the particles.

F. The Cushion Layer shall be compatible with the Wear Course and must meet requirements herein for impact attenuation.

2.4 WEAR COURSE

A. Wear Course shall consist of Ethylene Propylene Diene Monomer (EPDM), Thermal Plastic Vulcanized (TPV) granules with polyurethane binder formulated to produce an even, uniform, seamless surface. Installation of surfacing shall be seamless (unless otherwise agreed upon by Owner) and completely bonded to concrete of asphalt subsurface. Material shall cover all foundations and fill around all elements penetrating the surface.

B. EPDM shall be peroxide cured with an EPDM content of 26 percent and shall include a processing aid to prevent hardness with 26% poly content to maintain dynamic testing characteristics, weatherization and UV stability.

C. ASTM D2240 (Shore A) hardness of 55-65, not less than 26 percent rubber hydrocarbons.

D. Size of EPDM granules shall be 1-4mm across. Binder shall be not less than 20 percent of total weight of rubber used in the wear surface and shall provide 100 percent coating of the particles.

E. TPV shall be angular granules with a (Shore A) hardness of 65°A ±5 and particle size between 1-4mm. Binder shall be not less than 20 percent of total weight of rubber used in the wear surface and shall provide 100 percent coating of the particles.

F. Thickness of Wear Course shall be a minimum ½ inch (12.7 mm).

G. The Wear Course shall be porous.

2.5 BINDER

A. No Toluene Diphenyl Isocyanate (TDI) shall be used.

B. No filler materials shall be used in urethane such as plasticizers and the catalyzing agent shall contain no heavy metals.

C. Weight of polyurethane shall be no less than 8.5 lbs. /gal (1.02 Kg/1) and no more than 9.5 lbs. /gal (1.14 Kg/1).

D. Manufacturer is permitted to modify the type of urethane required to match extreme weather conditions. Substitutions must be equal to or exceed original quality.

2.6 TOT TURF ADVANTAGE (TPV) INSERTS

A. TPV Insert – Thermal Plastic Vulcanized (TPV) angular granules with a (Shore A) hardness of 65° A ± 5 and particle size between .5-1.5 mm shall be used.

B. Thickness of the TPV Insert shall be ½" – 5/8" inch.

C. TPV Insert shall be porous.

D. Aromatic or Aliphatic urethane to be used as a binder.

E. Location – TPV Insert to be installed under swings, swing bays, slide exits. Customer to approve location of wear mat inserts.

F. Standard Color TPV .5-1.5mm to be used. Colors include four standard colors: Terra Cotta Red, Blue, Green, and Beige.

G. Size: Swing bay use locations shall have TPV Inserts inclusive of all outside bay structure poles. Singular swings and slide exits shall be 4'x4'x1/2" in thickness.

2.7 MATERIALS

A. Wear Course – EPDM Granules and/or TPV Granules

Manufacturer:	NH Rubber Products and Rosehill Polymers
As Distributed by:	Robertson Industries Inc. (800) 858-0519
Location Used:	Playground Area

B. Cushion Layer – TotTurf Shredded and/or Chunk Rubber

As Distributed by: Robertson Industries Inc. (800) 858-0519
Location Used: Playground Area

C. Binder – Aromatic VORAMER MR Products

Manufacturer: DOW Chemical
As Distributed by: Robertson Industries Inc. (800) 858-0519
Location Used: Playground Area

D. Binder – Aromatic Urethane *Stobielast® S 1020*

Manufacturer: Stockmeier Urethanes, USA, Inc.
As Distributed by: Robertson Industries, Inc. (800) 858-0519
Location Used: Playground Area

E. Binder – Aliphatic Urethane Premium, Non-Ambering

Manufacturer: Accella Polyurethane Systems
As Distributed by: Robertson Industries Inc. (800) 858-0519
Location Used: Playground Area

F. Chunk Premium Black Rubber Granules

Manufacturer: American Recycling Center, Inc. (989) 725-5100
655 Wabassee Drive
Owosso, MI 48867
As Distributed by: Robertson Industries Inc. (800) 858-0519
Location Used: Playground Area

PART 3 – EXECUTION

3.1 SITE PREPARATION (OWNER OR OWNERS REPRESENTATIVE SHALL)

A. Finished Grade/Slope: Verify that finished elevations or adjacent areas are as indicated on the architectural or site plans, that the appropriate sub-grade elevation has been established for the safety surface to be installed, and that the subsurface has been installed per architectural, site or equipment plans while meeting accessibility and use zones requirements.

B. Aggregate Sub Base: Tolerance of aggregate sub base shall be with 3/8” inch (10mm) in 10’ ft. (3050 mm). Verify that aggregate sub base has been fully compacted. Per ADA Guidelines: compacted Aggregate sub base – 4” inches of ¾” inch minus irregular stone with fines compacted to 95% percent in 2” inch watered lifts.

C. Concrete Sub Base: Tolerance of concrete or bituminous sub base shall be with 1/8” inch (3.0 mm) in 10’feet (3050 mm). Per ADA Guidelines: Concrete a minimum of 3’ –

4’ inches at a minimum 2500 PSI. Concrete must cure for 7 days prior to application of cushion layer. Concrete must cure 28 days if wear course is to be applied directly to concrete surface. If Poured in Place surfacing is installed, verify that the Concrete Sub Base has cured (all areas appear white in color usually at 7 days) and that all concrete curing compounds and other deleterious substances that might adversely affect adhesion have been removed. Surface shall be clean and dry.

D. Asphalt Sub Base: Asphalt cure time requires 14 days. Once the new asphalt has cured, it must be pressure washed prior to the surfacing being installed. The contractor shall be responsible for flooding the pad to ensure proper slope and tolerance. Any areas holding enough water to cover a flat nickel shall be patched prior to the arrival of our installation crews.

E. Drainage: Verify that sub-surfacing drainage, if required, has been installed to provide positive drainage.

3.2 INSTALLATION

A. Poured in Place Surfacing: Components of the poured in place surfacing shall be mixed on site in a rotating tumbler to ensure components are thoroughly mixed and are in accordance with manufactures recommendations. Installation of surfacing shall be seamless up to 2,000 square feet per day and completely bonded to concrete of sub base. Material shall cover all foundations and fill around all elements penetrating the surface.

B. Cushion Layer: Whenever practical, cushion layer of surfacing material shall be installed in one continuous pour on the same day of up to 2,000 square feet. When a second pour is required, step the seam (see detail) and fully coat the step of the previous work with polyurethane binder to ensure 100 percent bond with new work. Apply adhesive in small quantities so that new cushion layer can be placed before the adhesive dries.

C. Wear Course: Wear Course must be either quality peroxide cured EPDM, TPV or Treated SBR granules. Wear surface shall be bonded to Cushion Layer. If necessary, additional primer will be used between the cushion layer and Wear Course. Apply adhesive to Cushion Layer in small quantities allowing the Wear Course to be applied before adhesive dries. Surface shall be hand troweled to a smooth, even finish. Except continuous and seamless up to 2,000 square feet per day (contact sales representative for seamless in excess of 2,000 square feet). Where seams are required due to color change, size or adverse weather, a step configuration will be constructed to maintain Wear Course integrity. The edge of initial pour shall be coated with adhesive and wearing surface mixture shall be immediately applied. Pads with multiple seams are encouraged to include a top coat of urethane before being placed into use. Butt joint seams are not acceptable except for repairs. Under special conditions and with owners

written approval seams may be permitted in same color pad. Consult with manufacturer for specific applications.

D. Perimeter: For installations over existing concrete, the perimeter must be saw cut to provide a keyway 1" inch deep x 1" inch wide, or formed during the pour, with surfacing rolled down into the void. Primer adhesive must be applied to all sides of the void. When connecting to a concrete curb or border, the inside vertical edge shall be primed with adhesive and the final 2" inches of the cushion layer shall be tapered to allow the wear surface material to be 1.5"– 2" thick where it joins the concrete.

E. Asphalt: When installing over new asphalt, a curb or other type of border is recommended around the entire pad to separate the new surface from other ground materials. Primer adhesive must be applied to the inside vertical edge of the border before poured in place surface installation.

F. Asphalt: When installing over existing asphalt, a key way cut of 1" inch deep by 1" inch side for the poured in place to taper into and terminate with required ADA slope.

G. Thickness: Construction methods such as the use of measured screeds or guides shall be employed to ensure that the full depth of specified surfacing material is installed. Surfacing system thickness throughout the playground equipment use zone shall be as required to meet the impact attenuation requirements specified herein.

H. Clean Up: Manufacturer installers shall work to minimize excessive adhesive on adjacent surfaces or play equipment. Spills of excess adhesive shall be promptly cleaned.

I. Protection: The safety surface shall be allowed to fully cure in accordance with Manufacturer's instructions. The surface shall be protected by the owner from all traffic during the curing period of 48 hours or as instructed by the Manufacturer.

J. Manufacturer Services: For poured in place safety surfacing, a manufacturer's representative who is experienced in the installation of playground safety surfacing shall be provided. The representative shall supervise the installation to ensure that the system meets the impact attenuation requirements as specified herein.

3.3 SITE AREA CLEAN UP

The site shall be kept clean and free of tools, trash, and debris and installation materials daily. Products may be stored on site during installation with appropriate protective measures and approval by the Owner's representative.

END OF SECTION

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Decorative metallic-coated steel tubular picket fences.
   2. Swing gates.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.

1.3 SUBMITTALS

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

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each fence material and for each color specified.
   1. Provide Samples 12 inches in length for linear materials.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for decorative metallic-coated steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.

1.4 QUALITY ASSURANCE

A. Accessibility Requirements for Door Hardware: (all requirements below shall apply to gates as well)
   1. Doors/doorways as part of an accessible route shall comply with CBC Sections 11B-404.
   2. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 4” maximum projections into it between 34” and 80” above the finish floor or ground. Door closers and stops shall be permitted to be 78” minimum above the finish floor or ground. CBC Section 11B-404.2.3
   3. Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34” minimum and 44” maximum above finish floor or ground. Where sliding doors are in

the fully open position, operating hardware shall be exposed and usable form both side. CBC Section 11B-404.2.7

4. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.
   a. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum.
   b. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (67N).
   c. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
   d. The force required to activate any operable parts, such as retracting latch bolts or disengaging other devices, shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
5. Door closing speed shall be as follows: CBC Section 11B-404.2.8.
   a. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds min.
   b. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
6. Thresholds shall comply with CBC Section 11B-404.2.5.
7. Floor stops shall not be located in the path of travel and 4” maximum from walls.
8. Hardware (including panic hardware) shall not be provided with “Night Latch” (NL) function for any accessible doors or gates unless the following conditions are met per DSA Interpretation 10-08 DSA /AC (External), latest revision. Such conditions must be clearly demonstrated and indicated in the specifications:
   a. Such hardware has a ‘dogging’ feature.
   b. It is dogged during the time the facility is open.
   c. Such ‘dogging’ operation is performed only by employees as their job function (non-public use).
9. Pair of doors: limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. CBC Section 11B-703.4.2.1.

B. Fences, gates and hardware:
   1. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.
   2. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2" of the (face of) gate to prevent catching on the clothing or persons. California Referenced Standards code. T-24 Part 12, Section 12-10-202, Item (F).
   3. Swing doors and gate surfaces within 10” of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16” of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code - Steel.”

D. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ornamental metal fences and gates that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Picket Fences and Gates:
   1. Ameristar Fence Products. (Basis of Design)
   2. Master Halco.
   3. Merchants Metals; a division of MMI Products, Inc.
   4. Xcel Fence.
   5. Or equal.

2.2 STEEL PICKET FENCES

A. Product: Montage II by Ameristar or equal.
   1. Grade: Commercial/Industrial.
   2. Rails: 1-3/4 by 1-3/4 by .105 inch.
   3. Pickets: 1 inch square, 14 gauge.
   4. Posts:
      a. 2-1/2 inch, 12 gauge for up to 6 feet.
      b. 3 inch, 12 gauge for 7 and 8 feet.
   5. Height: As indicated on Drawings.
   6. Construction: Panels welded, no assembly required. Rackable and bias able.
   7. Styles: Majestic.
   8. Finish: Factory powder coat.
      a. Color: As indicated on Drawings.
   9. Warranty: 20 years.

2.3 SWING GATES

A. Gate Configuration: As indicated.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes as indicated on Drawings.

E. Frame Corner Construction: Welded or assembled with corner fittings and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.

F. Additional Rails: Provide as indicated, complying with requirements for fence rails.

G. Infill:
1. Vehicular: Comply with requirements for adjacent fence.
2. Pedestrian: Perforated metal. Same factory finish as fencing.

H. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron.

I. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
1. Same factory finish as fencing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
1. Construction layout and field engineering are specified in Division 1 Section “Execution Requirements.”

3.3 FENCE INSTALLATION

A. Install fences according to manufacturer’s written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
    b. Concealed Concrete: Top 2 inches below gradeto allow covering with surface material. Slope top surface of concrete to drain water away from post.
3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
    a. Extend posts at least 5 inches into sleeve.
    b. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.
    a. Extend posts at least 5 inches into concrete.
    b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
6. Mechanically Driven Posts: Drive into soil to depth of 30 inches. Protect post top to prevent distortion.
7. Space posts uniformly at 6 feet o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.
    1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
    2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

END OF SECTION 323119

SECTION 328400 - IRRIGATION SYSTEM

The general provisions of the Contract, including the General Conditions and Special Conditions apply to work specific in this Section.

PART I - GENERAL

1.1 DESCRIPTION

A. Work Included: Unless otherwise specified, the construction of irrigation systems shall include the furnishing, installing and testing of mains, laterals, risers and fittings, quick couplers, ball valves, back flow preventers, furnishing and installing of irrigation controllers, booster pumps, excavation and backfill, and all other work in accordance with the plans and specifications for a complete operating system.

(1) The intent of the drawings and specification is to indicate and specify a complete and efficient irrigation system ready for use in accordance with the manufacturer's recommendations and meeting the recommended approval of the Landscape Architect. All work shall be in accordance with applicable City and County codes, and these plans/specifications.

(2) Irrigation systems shall be constructed to the sizes and grades and at the location shown on the drawings. Lines shown on the plans are essentially diagrammatic. Locations of all heads, valves, etc., shall be reviewed by the Landscape Architect at the time of construction. Do not exceed spacing of the heads as shown on plans.

(3) The applicable provisions of the General Conditions and the Special Conditions of these specifications shall govern the work of this section as if herein written in full.

(4) The Contractor shall maintain, continuously, a competent superintendent or foreman, satisfactory to the Owner, during the progress of work, with authority to act for him in all matters pertaining to the work.

(5) Work noted as "N.I.C.", "existing" or "to be supplied and/or installed by others" is not a part of this section.

(6) The work in this section shall be coordinated with all underground utilities and trades responsible for their installation. Any discrepancies in location from what is shown on the plans are to be brought to the attention of the Landscape Architect.

(7) Existing mainline is asbestos pipe and a certified contractor is to disconnect as shown on the plans and to make the new connection to PVC.

(8) Existing mainline location in the athletic field is by memory of the District M/O staff and not taken from as-built drawings. Contractor is to field verify existing routing.

B. Field Conditions: Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report to the Landscape Architect all conditions which prevent proper execution of this work.

The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

C. Permits and Fees: The contractor shall apply and pay for all necessary fees and permits required in the pursuit of his work as required by governing codes. If the contractor observes that a conflict exists between permit requirements and the work outlined in the drawings and specifications, the contractor shall notify the Landscape Architect in writing with a description of the necessary changes to the documents and the contract price difference.

D. All assemblies specified herein shall be installed in accordance with the respective details. In the absence of detail drawings or specifications pertaining to the specific items required to complete the work, the Contractor shall perform such work in accordance with the best standard practice and to the satisfaction of the Landscape Architect.

E. Irrigation Contractor is responsible for replacing or repairing any acts of theft or vandalism during construction, establishment, and maintenance periods.

F. Permission to shut off any water lines must be obtained from the Owner 48 hours prior to work being donw. Disruption of existing systems shall be kept to a minimum.

G. Contractor shall maintain irrigation system throughout plant establishment and maintenance period.

H. Contractor shall provide one year guarantee.

1.2 RELATED WORK DESCRIBED ELSEWHERE

A. Planting: Section 329300
B. Temporary Tree and Plant Protection 015639

1.3 QUALITY ASSURANCE

A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electrical Code and the Electrical Safety Orders of the State of California, Division of Industrial Safety, for all electrical work and materials.

B. It is the intention of this specification to accomplish the work of installing an automatic irrigation system, which will operate in an efficient and satisfactory manner. The irrigation system shall be installed and made operational according to the workmanlike standards established for landscape installation and sprinkler irrigation operation as set forth by the most recent Best Management Practices (BMP) of the Irrigation Association.

C. The specification can only indicate the intent of the work to be performed rather than a detailed description of the performance of the work. It shall be the responsibility of the Contractor to install said materials and equipment in such a manner that they shall operate efficiently and evenly and support optimum plant growth and health.

D. The Landscape Architect shall be the sole judge of the true intent of the drawings and specifications and of the quality of all materials furnished in performance of the contract.

E. The Contractor shall keep one copy of all drawings and specifications on the work site, in good order. The Contractor shall make these documents available to the Owner's Representative when requested.

F. In the event of any discrepancies between the drawings and the specification, the final decision as to which shall be followed, shall be made by the Owner's Representative.

G. In the event the installation is contradictory to the direction of the Owner's Representative, the installation shall be rectified by the Contractor at no additional cost to the Owner. The Contractor shall immediately bring any such discrepancies to the attention of the Owner's Representative.

H. It shall be distinctly understood that no oral statement of any person shall be allowed in any manner to modify any of the contract provisions. Changes shall be made only on written authorization of the Owner's Representative.

I. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work.

1. Installer Field Supervision: The installer shall maintain on site an experienced full-time supervisor who can communicate in English with the Owner's Representative.

2. Submit the installer's qualifications for approval.

1.4 CHANGES IN THE WORK

A. The Owner's Representative may order changes in the work, and the contract sum being adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and Contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.5 CORRECTION OF WORK

A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest as possible time that can be coordinated with other work, and seasonal weather demands, but not more than 90 (ninety) days after notification**.**

1.6 SUBMITTALS

A. General: Comply with the provisions of THE General Conditions for policy procedures related to submittals.

B. Materials lists: Within forty-five (45) days after award of the Contract, submit via electronic delivery a complete LIST of all materials proposed to be furnished and installed under this Section, demonstrating complete conformance with the requirements specified.

(1) Materials list shall include Valves, Piping, Glue, Heads, Nozzles, etc.

C. Materials and Samples: If materials are to be employed, other than designated on the plans, the Contractor shall, prior to the installation of any irrigation work, submit for recommended approval by the Landscape Architect, a list of materials and equipment he proposes to use. Samples shall be submitted a sufficient time in advance of the start of construction to allow a period of not less than seven (7) days for testing and recommended approval. The material and equipment list shall include, but not be limited to, polyvinyl chloride pipe, automatic controllers, control valves, quick coupling valves and irrigation heads/nozzles.

(1) Recommended approval of irrigation equipment and materials shall depend on the following:

(a) Conformance to specification requirements.

(b) Acceptable test results and/or field performance.

(c) Durability and low maintenance.

(d) Availability of parts and service.

(e) Compatibility with owner's materials inventories.

D. As built RECORD set of DRAWINGS:

(1) The Contractor shall provide and keep up to date, a complete record set of black line prints which shall be corrected daily and show every change from the original drawings and specifications and the exact locations, sizes and kinds of equipment. Prints for this purpose may be obtained from the Landscape Architect.

(2) The drawings shall also serve as work progress sheets, and the contractor shall make neat and legible annotations thereon daily as the work proceeds, showing the work as actually installed. These drawings shall be available at all times for inspections and shall be kept in a location designated by the Owner’s Rep.

(3) In order to complete the record drawings in a neat, legible manner, the contractor shall employ a competent draftsman, satisfactory to the Owner's Rep., to indicate the necessary changes on black line prints procured from the Owner. The drawings shall be transmitted to the Owner’s Representative in paper format and as a pdf file of each document on compact disk or flash drive two weeks prior to final acceptance.

(4) The contractor shall dimension from two (2) permanent points of reference, building corners, sidewalks, or road intersections, etc., the location of:

- The routing of the sprinkler main lines, sleeving,
- Connections to the existing **ASBESTOS** water lines
- Control valves, shut-off valves, quick coupling valves
- Any other pertinent underground item, if so deemed by the Landscape Architect.
- All valves shall be numbered by station and corresponding numbers shall be shown on the as built record set of drawings.
- Controller locations with grounding rods
- wire runs, rain sensors, wire splice locations

- All changes in direction and depth of main line pipe shall be noted exactly as installed. Dimensions for pipes shall be shown at no greater than a 50 ft. maximum interval.

(5) As built record set of drawings shall be signed and dated by the Contractor attesting to and certifying the accuracy of the as built record set of drawings. It shall have "As Built Record Set of Drawings", company name, address, phone number and the name of the person who created the drawing and the contact name. (if different).

E. Testing data from required pressure testing.

F . Irrigation Controller certification from the manufacturer or authorized distributor, verifying correct installation in accordance to their requirements.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Delivery: Polyvinyl chloride pipe shall be delivered to the work site in unbroken bundles or rolls packaged in such a manner as to provide adequate protection for the pipe ends, threaded or plain.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the recommended approval of the Architect and at no additional cost to the Owner.

1.8 PROTECTION

A. The Contractor shall continuously maintain adequate protection of all their work from damage, destruction, or loss, and shall protect the owner's property from damage arising in connection with this contract. Contractor shall make good any such damage, destruction, loss or injury. Contractor shall adequately protect adjacent property as provided by law and the contract documents.

B. The Contractor shall maintain sufficient safeguards, such as railings, temporary walks, lights, etc., against the occurrence of accidents, injuries or damage to any person or property resulting from their work, and shall alone be responsible for the same if such occurs.

C. All existing paving, structures, equipment or plant material shall be protected at all times, including the irrigation system related to plants, from damage by workers and equipment. The Contractor shall follow all protection requirements including plant protection provision of the general contract documents. All damages shall be repaired or replaced at the Contractor's expense. Repairs and or replacement shall be to the satisfaction of the Owner's Representative, including the selection of a Contractor to undertake the repair or maintenance. Repairs shall be at no cost to the owner.

D. For trees damaged to the point where they will not be expected to survive or which are severely disfigured and that are too large to replace, the cost of damages shall be as determined by the Owner's arborist using accepted tree value evaluation methods.

E. The Contractor shall refrain from trenching within the drip line of any existing tree to

remain. The Owner's Representative may require the Contractor to relocate proposed irrigation work, bore lines beneath roots or use air-spade technology to dig trenches through and under the root system to avoid damage to existing tree root areas.

1.9 EXCAVATING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

1. Do not begin any excavation until all underground utilities have been located and marked.

2. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain stakes and or markings set by others until parties concerned mutually agree to their removal.

B. Section 4216/4217 of the government code requires a dig-alert identification number be issued before a "permit to excavate" will be valid. For your dig-alert identification number call underground service alert toll free 1-800-422-4133 two working days before beginning construction.

1.10 TEMPORARY UTILITIES

A. All temporary piping, wiring, meters, panels and other related appurtenances required between source of supply and point of use shall be provided by the Contractor and coordinated with the Owner's Representative. Existing utilities may be used with the written permission of the owner.

1.11 CUTTING, PATCHING, TRENCHING AND DIGGING

A. The Contractor shall do all cutting, fitting, trenching or patching of their work that may be required to make its several parts come together as shown upon, or implied by, the drawings and specifications for the completed project.

B. Digging and trenching operations shall be suspended when the soil moisture is above field capacity.

PART 2 - PRODUCTS

2.1 RECLAIMED WATER SYSTEM DESIGNATION

A. Where irrigation systems use reclaimed water, all products including valve boxes, lateral and main line pipe, etc. where applicable and/or required by local code shall have the reclaimed water purple color designation.

2.2 PIPE

A. Plastic Pipe:

(1) Unless otherwise specified, the construction of lateral lines and main lines shall include excavation and backfill, the furnishing, installing and testing of pipe, tube and fittings, the furnishing and installing of anchors, thrust blocks and location wire, the improvements, line flushing and testing, and all other work in accordance with the plans and specifications.

(2) Main supply pressure lines shall be PVC; 4" and larger Class 200, 2" - 3" Class 315, 1 1/2" and smaller Schedule 40, as manufactured by Lasco Industries, or approved equal.

(a) Sand shall consist of natural or manufactured granular material, free of organic material, mica, loam, clay or other substances not suitable for the intended purpose.
(b) Sand shall be masonry sand ASTM C 144 or coarse concrete sand, ASTM C 33.

(3) Lateral non-pressure lines shall be PVC. Schedule 40 polyvinyl chloride, as manufactured by Lasco Industries, or approved equal.

(4) Irrigation Line Sleeves shall be PVC. Schedule 40 polyvinyl chloride, as manufactured by Lasco Industries, or approved equal.

(5) Low Voltage Control Wire Sleeves (valve wires) shall be PVC Schedule 40 polyvinyl chloride, as manufactured by Lasco Industries, or approved equal. All exposed wires shall be sleeved in PVC Schedule 40 ULV electrical conduit with ULV Schedule 40 fittings.

B. Identification: All pipe shall be continuously and permanently marked with the following information: The normal pipe size, the type and schedule or class of material, the working pressure or pressure rating at 73.4 degrees F., the manufacturer's name or trade mark, and the National Sanitation Foundation (N.S.F.) seal of approval.

C. Polyvinyl Chloride Pipe Fittings and Connections:

(1) Polyvinyl chloride pipe fittings and connections approved for irrigation systems shall be polyvinyl chloride, Type II, Grade I, Schedule 40, high impact molded fittings, manufactured from virgin compounds.

(2) The Schedule 40 fittings shall be tapered socket type, or molded thread type, suitable for either solvent weld or screwed connections.

(3) Machine threaded fittings will be acceptable only if thread-stripping resistance test results are submitted and approved.

(4) In line fittings, such as couplings, unions and bushings may be machined from extruded stock.

(5) Plastic saddle and flange fittings will not be acceptable.

(6) All fittings shall be permanently marked with the following information: The normal pipe size, the type and schedule of material, and the National Sanitation Foundation (N.S.F.) seal of approval.

D. Galvanized Pipe and Fittings:

(1) All galvanized steel pipe shall be Schedule 40, threaded, coupled and hot-dip galvanized, and shall comply with ASTM A120 and A53.

(1) All fittings for galvanized steel pipe shall be 150 PSI rated galvanized malleable iron, banded pattern.

(3) Pipe sizes indicated on the drawings are nominal inside diameter unless otherwise noted.

E. Brass pipe fittings, unions and connections:

(1) Standard 125 pound class 85% red brass fittings and connections, IPS threaded.

F. PVC Schedule 80 threaded risers and nipples:

(1) Type I, grade 1, Schedule 80, high impact molded, manufactured from virgin compounds as specified for piping and conforming to ASTM D-2464.

(2) Threaded ends shall be molded threads only. Machined threads are not acceptable.

2.3 SOLVENT CEMENTS AND THREAD LUBRICANT

A. Solvent cements shall comply with ASTM D2564. Socket joints shall be made per recommended procedures for joining PVC plastic pipe and fittings with PVC solvent cement and primer by the pipe and fitting manufacturer and procedures outlined in the appendix of ASTM D2564.

B. Thread lubricant shall be Teflon ribbon-type, or approved equal, suitable for threaded installations as per manufacturer's recommendations.

C. Pipe Joint Compound (Pipe dope) shall be used on all galvanized threaded connections. Pipe Joint Compound is a white colored, non-separating thread sealant compound designed to seal threaded connections against leakage due to internal pressure. It shall contain PTFE (Polytetrafluoroethylene) to permit a tighter assembly with lower torque, secure permanent sealing of all threaded connections and allow for easy disassembly without stripping or damaging threads.

2.4 BACKFLOW PREVENTION DEVICES

A. Existing device on the back of the Admin Building is to be protected in place.

2.5 PRESSURE REGULATOR

A. Pressure regulator shall certified to NSF/ANSI 372, consisting of low lead bronze body bell housing, a separate access cap shall be threaded to the body and shall not require the use of ferrous screws.

B. The main valve body shall be cast bronze (ASTM B 584).

C. The access covers shall be bronze (ASTM B 584 or Brass ASTM B 16)

D. The assembly shall be of the balanced piston design and shall reduce the pressure in both flow and no flow conditions.

E. Pressure regulator shall be as indicated on the drawings.

2.6 VALVES

A. Ball Valves:

(1) All ball valves shall be all bronze construction full port; 1/2" thru 2", Nibco T585.

(2) Working Pressure Rated: 150 PSI stem, 400 PSI W.O.G.

(3) Ball valves installed underground shall be housed in a Carson/Brooks plastic turf box.

B. Butterfly Valves:

(1) All butterfly valves shall be 2 1/2" and larger, Nibco WD2000.

(2) Butterfly valves installed underground shall be housed in a Carson/Brooks plastic turf box.

C. Check Valves:

(1) Swing check valves 2 inch and smaller shall be 200 lbs., W.O.G., bronze construction with replaceable composition, neoprene or rubber disc and shall meet or exceed federal specification WW-V- 5ld, class a, type iv.

(2) Anti-drain valves shall be of heavy-duty virgin PVC construction with female iron pipe thread inlet and outlet. Internal parts shall be stainless steel and neoprene. Anti-drain valves shall be field adjustable against draw out from 5 to 40 feet of head.

(3) Check valves shall be as indicated on the drawings.

D. Remote control valves

(1) Remote control valves shall be electrically operated, single seat, normally closed configuration, equipped with flow control adjustment and capability for manual operation.

(2) Valves shall be actuated by a normally closed low wattage solenoid using 24 volts, 50/60 cycle solenoid power requirement. Solenoid shall be epoxy encased. A union shall be installed on the discharge end.

(3) Remote control valves shall be wired to controller in same numerical sequence as indicated on drawings.

(4) Remote control valves shall be as indicated on the drawings.

(5) All valves shall have a T.C. Christy valve marking plastic tag.

E. Master control valves

(1) All master valves shall be electrically controlled, hydraulically operated, single seat, normally closed no equivalents or equals.

F. Flow sensor

(1) Flow sensor shall be compatible with the irrigation controller.

(1) Flow sensor shall be as indicated on the drawings.

G. Quick coupler valves

(1) Quick coupler valves shall be a one or two piece, heavy-duty brass construction with a working pressure of 150 PSI with a built in flow control and a self-closing valve.

(2) Quick coupler shall be equipped with locking red brass cap covered with durable yellow thermo-plastic rubber cover. Key size shall be compatible with quick coupler and of same manufacturer.

(2) Quick coupler valves shall be as indicated on the drawings.

H. Valve Boxes:

(1) Valve boxes shall be constructed of ABS (acrylonitrile butadiene styrene) plastic, green in color, with rigid base and sides and shall be supplied with bolt lock cover secured with stainless steel bolts. Cover shall be identified as shown on drawings. Provide box extensions as required.

(2) Master valves, flow sensors, remote control irrigation valves, gate valves, and ball valves 3 inch or less in size shall use a 14 inch x 19 inch x 12 inch rectangular box.

(3) Quick coupler valves, wire splices, and grounding rods shall use a 10 inch circular box.

2.7 AUTOMATIC CONTROLLERS (ELECTRIC):

A. Controller shall be housed in a sturdy, locking, weather-resistant case, furnished for maximum exterior protection.

B. Controller shall be equipped with evapo-transpiration (ET) sensor, which adjusts the controller programming based on local climatic conditions. The sensor shall also have a rain sensing shut-off switch, wind sensing shut off switch, and freeze sensing shut-off of switch.

(1) If a moisture sensor is used in lieu of an evapo-transpiration sensor an additional sensor, which has a rain-sensing shut-off switch, wind sensing shut-off switch, and freeze sensing shut-off switch shall be provided.

C. Automatic controller shall be as indicated on the drawings.

2.8 CONTROL WIRE:

A. All control wire shall be of the Underwriter's Laboratory type UF (underground feeder), single conductor, solid copper, plastic insulated, 600 volt rated, for direct burial applications. Maximum conductor operating temperature, 60 degrees C. for both wet and dry locations. Wire composition is as follows:

(1) Conductor - The conductors shall be solid annealed uncoated copper meeting the applicable requirements of the latest revisions of A.S.T.M. B-3.

(2) Insulation - The insulation shall be colored plastic which meets the test requirements of I.P.C.E.A. (The Insulated Power Cable Engineer's Association) Pub. No. S-61-402, dated July 1961, Section 3.7 for 60 degrees C. polyvinyl chloride insulation. The insulation shall be flame retardant, resistant to fungus, resistant to corrosive fumes, suitable for wet locations and furnish some degree of inherent protections against mechanical abuse. Insulation thickness shall be 47 mils for AWG #14, 12 & 10, and 62 mils for AWG #8.

(3) Color Coding - The conductor insulation shall be color coded as follows:

(a) All common ground wire shall be white.

(b) All pilot (valve control) wire shall be color coded per valve. (spare wiring to be different color pattern from original wiring)

2.9 SPRINKLER HEADS:

A. All sprinkler heads shall have check valves installed.

B. All sprinkler heads shall be as indicated on the drawings.

C. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body and fabricated as shown on the drawings.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

(1) Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

(2) Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the reference standards and the manufacturer's recommendations.

B. Discrepancies:

(1) In the event of discrepancy, immediately notify the Landscape Architect.

(2) Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 TRENCHING/SLEEVING MEASURMENTS

A. General:

(1) Trenches and other excavations for irrigation pipe and appurtenances shall be excavated true to alignment and grade, and shall be of ample size for the proper performance of installation work, review, testing and backfill.

(2) Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots.

(3) Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots by hand digging within the drip line.

(4) Generally, piping under concrete shall be installed by jacking, boring or hydraulic driving. Where any cutting or breaking of sidewalks and/or concrete work is necessary, it shall be removed and replaced by the Contractor. Permission to cut or break sidewalks and/or concrete shall be obtained from the Architect. No hydraulic driving will be permitted under asphaltic concrete paving.

(5) Coordinate with planting operations, as 10" deep cross-ripping is required prior to irrigation systems installation. (cross-ripping is part of the planting work).

B. Plastic Pipe Trenches:

(1) Minimum trench width shall be six (6) inches.

(2) Minimum trench depth below bottom of pipe shall be two (2) inches.

(3) Minimum cover shall be based on finished grades, unless otherwise noted on Drawings.

(a) Lateral Line minimum cover shall be twelve (12) inches.

(b) Main Line minimum cover shall be eighteen (18) inches for pipe 2 ½” and smaller, twenty-four (24) inches for pipe 3” and larger.

(c) Pipe and Wire Sleeves minimum cover shall be twenty-four (24) inches.

(4) On new on-site systems (post-meter), the required horizontal separation between potable water lines, reclaimed water constant pressure main lines and sewer lines shall be a minimum of four (4) feet apart as directed by the project engineer and/ or regulatory agency. Measurements shall be between facing surfaces, not pipe centerlines.

C. Backfill Material:

(1) All plastic pipe shall be bedded and encased with approved backfill material free of rocks and clods as indicated in the following table and/or shown on the plans.

Thickness Under Pipe Minimum	Thickness Above Pipe Minimum	Thickness at Side Pipe Minimum
Two (2) inches	Four (4) inches	Two (2) inches

(2) The balance of backfill material shall be approved soil. Unsuitable material, including clods and rocks over 2 to 2-1/2 inches in size, shall be removed from the premises and disposed of legally at no cost to the Owner.

(3) Backfill material shall be sufficiently compacted under and on each side of the pipe to provide support free of voids. On slope areas over 3:1 gradient compaction shall be 85% (min) or equal to the requirements of the grading plans, whichever is greater. Pipe joints shall remain exposed until the completion of pressure and leakage test, unless authorized by the Architect. The top six (6) inches of backfill shall be free of rocks over one (1) inch, subsoil, rubbish and debris.

(4) The remainder of the backfill material shall contain no lumps or rocks larger than two and one-half (2-1/2) inches, nor contain rubbish and debris.

(5) Backfill shall be tamped or puddled to the dry density of adjacent soil. Backfill within areas of structurally compacted soils shall be returned to the original relative density as before trenching.

D. Location Wire:

(1) Location wire shall be placed on top of the four-inch select backfill over all mainline (pressure bearing) pipes, except copper pipe. Wire shall be No. 12 gauge copper, new or used or an approved substitute, and shall provide a continuous electrical conductor between gate valves and control valves. Each end shall be brought to the valve sleeve and two feet of wire looped free in the trench beside the valve body. This location wire may be omitted where copper hydraulic control tubing or electric control wire follows the water main.

3.3 PIPE INSTALLATION

A. Under no circumstance is pipe to rest on concrete, rock, wood blocks, construction debris or similar items.

B. No water shall be permitted in the pipe until a period of at least 24 hours has elapsed for solvent weld setting and curing.

C. Install assemblies and pipe to conform to respective details and where shown diagrammatically on drawings, using first class workmanship and best standard practices as approved. All fittings that are necessary for proper connections such as swing joints, offsets, and reducing bushings that are not shown on details shall be installed as necessary and directed as part of the work.

D. Gasketed plastic pipe: pipe-to-pipe joints or pipe to fittings shall be made in accordance with manufacturer’s specifications.

E. Solvent weld or threaded plastic pipe:

(1) Installation of all pipe and fittings shall be in strict accordance with manufacturer's specifications.

(2) Pipe shall be cut using approved PVC pipe cutters only. Sawed joints are disallowed. All field cuts shall be beveled to remove burrs and excess before gluing.

(3) Welded joints shall be given a minimum of 15 minutes to set before moving or handling. Excess solvent on the exterior of the joint shall be wiped clean immediately after assembly.

(4) Plastic to metal connections shall be made with plastic adapters and if necessary, short (not close) brass threaded-nipples. Connection shall be made with two (2) wraps of Teflon tape and hand tightened plus one turn with a strap wrench.

(5) Snake pipe horizontally in trench to allow one (1) foot of expansion and contraction per 100 feet of straight run.

(6) Threaded pipe joints shall be made using Teflon tape. Solvent shall not be used with threaded joints. Pipe shall be protected from tool damage during assembly. All damaged pipe shall be removed and replaced. Take up threaded joints with light wrench pressure.

(7) No close nipples or risers are allowed. Cross connections in piping is disallowed.

(8) Center load pipe at 10 feet on center intervals with small amount of backfill to prevent arching and slipping under pressure. Other than this preliminary backfill all pipe joints, fittings and connections are to remain uncovered until successful completion of hydrostatic testing and written approval of the testing report.

(9) Concrete thrust blocks shall be constructed behind all pipe fittings 1-1/2 inch diameter and larger at all changes of direction of 45 degrees or more.

F. Galvanized Pipe Installation

(1) All joints shall be threaded with pipe joint compound used on all threads.

(2) Dielectric bushings shall be used in any connections of dissimilar metals.

3.4 FLUSHING

A. Openings in piping system during installation are to be capped or plugged to prevent Dirt and debris from entering pipe and equipment. Remove plugs when necessary to flush or complete system.

B. After completion and prior to the installation of any terminal fittings, the entire pipeline system shall be thoroughly flushed to remove dirt, debris or other material.

3.5 HYDROSTATIC PRESSURE TESTING

A. After flushing, and the installation of valves the following tests shall be

conducted in the sequence listed below. The Contractor shall furnish all equipment; materials and labor necessary to perform the tests and all tests shall be conducted in the presence of the Owner's Representative.

B. Water pressure tests shall be performed on all pressure main lines before any couplings, fittings, valves and the like are concealed.

C. Immediately prior to testing, all irrigation lines shall be purged of all entrapped air or debris by adjusting control valves and installing temporary caps forcing water and debris to be discharged from a single outlet.

D. Test all pressure main line at 150 PSI. For a minimum of four (4) hours with an allowable loss of 5 PSI. Pressure and gauges shall be read in PSI, and calibrated such that accurate determination of potential pressure loss can be ascertained.

E. Re-test as required until the system meets the requirements. Any leaks, which occur during test period, will be repaired immediately following the test. All pipe shall be re-tested until final written acceptance.

F. The Contractor is responsible for proving documentation stating the weather conditions, date, the start time and initial water pressure readings, the finish time and final water pressure readings and the type of equipment used to perform the test. The documentation must be signed by a witness acceptable to the Owner, verifying all of the above-mentioned conditions.

G. Submit a written report of the pressure testing results with the other above required information to the Owner's Representative for approval.

3.6 BACKFILLING AND COMPACTING

A. Irrigation trenches shall be carefully backfilled with material approved for backfilling and free of rocks and debris one (1) inch in diameter and larger. When back filling trenches in areas of imported or modified planting soil, replace any excavated subsoil at the bottom and the imported soil or modified planting soil at the top of the trench.

B. Backfill shall be compacted with approved equipment to the following densities

(1) Backfill under pavement and within 2 feet of the edge of pavement: Compact to 95% or greater of maximum dry density standard proctor.

(2) Backfill of subsoil under imported planting mixes or modified existing planting soil: 85 % of maximum dry density standard proctor.

(3) Backfill of imported planting mixes or modified existing planting soil: Compact to the requirements of the adjacent planting mix or planting soil as specified in section "Planting Soil".

C. Finish grade of all trenches shall conform to adjacent grades without dips or other irregularities. Dispose of excess soil or debris off site at Contractor's expense.

D. Any settling of backfill material during the maintenance or warranty period shall be repaired at

the Contractor's expense, including any replacement or repair of soil, lawn, and plant material or paving surface.

3.7 INSTALLATION OF CONTROL WIRES

A. Unless otherwise specified, the installation of control wire shall include excavation and backfill, the furnishing, installing and testing of the wires, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.

B. Unless otherwise specified all neutral (common ground) wire shall be AWG #12 and all pilot (valve control) wire shall be AWG #14.

C. Spare wires shall be installed from the controller clock to the most distant valves as noted on plans. When wire runs go in different directions from the controller clock, separate spare wires shall be installed from the controller clock to the most distant valve in each different wire run direction. Their colors shall differ from valve wires used.

D. Tape and bundle all control wires at 10' o/c maximum; place wiring with 18" minimum cover. When wiring is placed in common trenches with piping, set wiring 2" from any piping.

E. All wire splicing shall take place in the valve boxes and/or pull boxes. All splices shall be made with a mechanical connector encased in a self-curing epoxy resin which provides a permanent watertight connection.

F. All direct burial control wires shall be identified as to their respective valve number and controller clock letter in all pull boxes and at all wire termination. Spare wires and "future valve" wires, if any, shall also be identified. Labels and tags shall be used for identification which are not affected by moisture or temperatures between minus 30 degrees F. and plus 200 degrees F. The labels and tags shall be resistant to abrasion, dirt, grease, and chemicals used in lawn fertilizers and conditioners. The labels and tags shall be firmly attached to the wire in every case.

G. The final operating sequence of the remote control valves, within each individual controller clock, shall be as called out on drawings.

H. Testing:

(1) All direct burial control wire installed shall be tested in the following manner.

-Before any backfill material is placed over the control wires in the trench, the wires shall be tested with a meter for insulation resistance. Minimum insulation resistance to ground shall be fifty (50) megohms. Any conductor not meeting this requirement shall be replaced.

-After backfill encasement, the wires shall again be tested with a meter. The minimum acceptable insulation resistance to ground on this test shall be one (1) megohm. Any conductor not meeting this requirement shall be replaced.

I. Provide separate common wire for each controller installed.

3.8 INSTALLATION OF VALVES

A. General:

(1) All equipment shall be installed to meet all installation requirements of the product manufacturer. In the event that the manufactures requirements cannot be implemented due to particular condition at the site or with other parts of the design, obtain the Owner's Representative's written authorization and approval for any modifications.

(2) Install all equipment at the approximately at the location(s) and as designated and detailed on the drawings. Verify all locations with the Owner's Representative.

(3) Install all valves within a valve box of sufficient size to accommodate the installation and servicing of the equipment. Group valves together where practical and locate in shrub planting areas.

(4) All sprinkler irrigation systems that are using water from potable water systems shall require backflow prevention. All backflow prevention devices shall meet and be installed in accordance with requirements set forth by local codes and the health department.

B. Ball / Butterfly Valves: Valves installed underground shall be housed in a Carson/Brooks plastic turf box. The Contractor shall brand, BV on the outside cover of the box.

C. Automatic Control Valves: Automatic control valves shall be set upright and housed in plastic Carson/Brooks turf box, with a lockable, top. The Contractor shall brand, the identification number of the valve and clock on the inside and outside cover of the box.

D. Quick Couplers: Quick Couplers shall be installed on galvanized risers and housed in plastic Carson/Brooks turf box, with a lockable top. The Contractor shall brand, QC on the outside cover of the box.

E. Pressure Reducing Valves: Pressure Reducing Valves shall be set upright and housed in plastic Carson/Brooks turf box, with a hinged, lockable, top. The Contractor shall brand, PR on the outside cover of the box.

3.9 INSTALLATION OF AUTOMATIC CONTROLLERS

A. Unless otherwise specified, the installation of automatic controllers shall include the furnishing, the installing, making necessary electrical connections, the testing of controllers and connection, and all other work as called for on the plans and/or in the specifications.

B. All electrical conduit shall be P.V.C. Sunstop ULV Schedule 40 pipe & fittings.

C. Install controllers at 5' min. away from 3 phase power.

D. Unless otherwise specified the installation of controllers shall be as detailed on plan.

E. Controllers shall be tested for fourteen (14) calendar days after complete installation of the sprinkler system. System shall operate automatically in the manner shown on the drawings and/or specified herein.

3.10 INSTALLATION OF SPRINKLER HEADS

A. Unless otherwise specified, the installation of sprinkler heads shall include excavation and backfill, the furnishing, installing and testing of risers, fittings and heads, the furnishing and installing of anchors and thrust blocks, the furnishing and installing of cone shaped screens at base of each head, the removal and/or restoration of existing improvements and all other work shall be in accordance with the plans and specifications.

B. Flushing: All water lines shall be thoroughly out before heads are installed.

C. Location and arc of heads shall be adjusted, if required to eliminate any dry spots, over water or spillage on adjacent areas.

D. All seeded area sprinkler heads shall be installed adjacent to existing walks, curbs, or other paved areas, shall be set to the grade of the improvements. Sprinkler heads which are to be installed in areas where the turf has not yet been established shall be set two (2) inches above the proposed finished grade. Heads installed in this manner shall be lowered by the Contractor prior to final acceptance. In established lawn areas the sprinkler heads shall be set to existing grade.

E. All shrubbery heads to be installed within three (3) feet of curbs shall be set to a maximum height of six (6) inches above the grade of the curb. Shrubbery heads installed in all other areas shall be twelve (12) inches above finished grades unless otherwise indicated on the plans. Pop-up shrub heads shall be installed as detailed.

3.11 TURNOVER ITEMS

A. Operation and maintenance manuals

(1) Prepare and deliver to the Owner’s Representative within ten calendar days prior to completion of construction, two 3-ring hard cover binders containing the following information:
- Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturers' representatives.
- Catalog and parts sheets on all material and equipment.
- Complete operating and maintenance instruction for all major equipment.
- Irrigation product manufacturers warrantees.
- In addition to the above-mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for maintaining major equipment and show evidence in writing to the Owner’s Representative at the conclusion of the project that this has been rendered.

B. Controller Charts:

(1) Provide one controller chart for each controller supplied.

(2) Record drawings shall be recommended for approval by the Landscape Architect before charts are prepared.

(3) These charts shall be completed and reviewed prior to final observation of the irrigation system, and prior to final payment.

(4) The chart shall show the area controlled by automatic controller and shall be no larger than the 24" x 36" original.

(5) The chart is to be a reduced drawing of the actual system. However, the chart shall only be reduced to a size which is completely legible.

(6) Chart shall be black line print and shall be colored with a different color marker for each station.

(7) The chart shall be mounted using Velcro, or an approved equal type of tape.

(8) When completed and recommended for approval, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils thick.

C. Turnover Items: Supply as part of this contract the following items:

(1) Four (4) additional sprinkler heads/nozzles of each type and pattern shown on plans.

(2) Two (2) wrenches for disassembly and adjustment of each type of sprinkler head shown on plans.

(3) Two (2) keys for each automatic controller.

(4) Two (2) quick couplers with a 3/4" bronze hose bib, bent nose type with hand wheel and two (2) quick coupler keys to match quick couplers shown on plan.

(5) Two (2) valve box cover keys or wrenches.

(6) One (1) 5-foot tee wrench for operating butterfly valves 3 inches or larger.

(7) Backflow device valve handles and Water Department inspection documentation.

3.12 TESTS

A. Pressure Tests:

(1) All pressure lines shall be tested under hydrostatic pressure of 125 pounds per square inch, and all non-pressure lines shall be tested under the existing static pressure and both be proved watertight. Contractor shall provide all equipment for hydrostatic tests at no cost to the Owner.

(2) Pressure shall be sustained in the lines for not less than two (2) hours. If leaks develop, the joints shall be replaced and the test repeated until the entire system is proved watertight.

(3) Tests shall be observed and recommended for approval by the Landscape Architect prior to backfill.

B. Coverage Test:

(1) When the irrigation system is completed, the Contractor, in the presence of the Architect, shall perform a test coverage of water afforded the planting areas, complete and adequate. 125% coverage for all turf areas. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage disclosed arising from his work.

(2) Contractor shall inform the Landscape Architect of any deviation from the plan required due to wind, planting, soil or site conditions that bear on proper coverage; and upon approval, perform changes to provide for proper coverage at no additional cost to the Owner.

3.13 REVIEWS

A. Normal Progress Reviews: Normal progress reviews shall be requested from the Architect at least 48 hours in advance of any anticipated review. A review will be made by the Architect on each of the steps listed below. The Contractor will not be permitted to initiate the succeeding steps of work until he has received written approval to proceed by the inspector.

(1) Irrigation materials and equipment to be used, by L.A.

(2) After trenching and before backfill by site IOR. Email or letter to be sent to LA confirming trench depths

(3) Completion of line testing, test to be made prior to backfill by site IOR. Email or letter to be sent to LA confirming test results.

(4) After placement of all heads, valves and controllers for coverage by L.A.

(5) Final review and receipt of "Record Drawings"/"Controller Charts" by District Rep.

(6) Final acceptance of project by L.A.

(7) In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval. Any work covered prior to review shall be opened to view by the Contractor, at his expense.

B. Unprepared Review Requests: In the event the Contractor requests review of work and said work is incomplete, the Contractor shall be responsible for review cost.

C. Completion: The work will be accepted, in writing, when the whole shall have been completed satisfactorily to the Owner and the Architect. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved by Owner, in writing, at the proper times.

(1) Leave the entire installation in complete operating order, free from any and all defects in material, workmanship or finish, regardless of any discrepancies and/or omissions in plans or specifications.

3.14 MAINTENANCE PERIOD

A. Maintenance of irrigation system prior to job completion, and during the Landscape Maintenance period, shall be the responsibility of the Contractor including, but not limited to, the following:

- Cleaning of plugged irrigation heads.
-Irrigation heads adjustments.
-Volume of water being applied (coordinate with landscape maintenance.)
-Programming of the controller (coordinate with landscape maintenance.)
-Repairing leaking valves, etc.
-Any other problem areas which occur after installation attributed to the irrigation system.
-Repair or replace equipment due to acts of vandalism, theft or pest damage.
-Lower all seeded area heads to final grades prior to final acceptance by Owner.

3.15 LONG TERM MAINTENANCE

A. All areas shall be kept free of debris.

B. The irrigation system is to be maintained in such a manner as to ensure the intended water efficiency designed. Maintenance contractor is to check, adjust, and repair irrigation equipment with like material on a weekly basis to avoid overspray, runoff, and/or broken components.

C. The controller is scheduled to adjust itself during the various seasons, excessive rains, excessive heat, but will need fine tuning as the plant material establishes and again when mature. Refer to schedules provided.

D. A copy of the water schedules are to be given to all new and existing maintenance crews and the controller manufacturer is to be contacted for instruction on the operation and maintenance of the smart controller.

E. Irrigation water audits shall be performed every five (5) years by a licensed water auditor in good standing. Any findings are to be addressed at the time of the audit.

END OF SECTION

SECTION 32 91 13 - SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of all Landscape Planting work as indicated on the Drawings, or as reasonably implied, or as designated herein, including, but not limited to, the following:

Landscape Mounding.
Soil testing approvals.
Soil preparation.
Finish grading.
Preparation of all planting holes.
Furnishing and installation of all required fertilizers, planting backfill materials

Related Requirements:

1. Section 01 56 39 “Temporary Tree and Plant Protection
2. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.
3. Section 31 20 00 “Earth Moving” for bioretention basin sizing.
4. Section 32 93 00 "Planting" for placing planting soil and mulch for plantings.

1.3 DEFINITIONS

A. Soil Type 1: General Planting

B. Soil Type 2: General Turf

1.4 BASIS OF DESIGN

A. The planting soil design is to be based on agricultural field-testing recommendations of **on-site stockpiled top soils.**

1. When products are identified by manufacturer name with no additional notation, the use of that manufacturer name and product name is not intended to limit the selection of equal products by other manufacturers. However, use of equal products by other manufacturers is subject to the requirements of Section 012500 “Substitution Procedures.”

1.5 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

B. CEC: Cation exchange capacity.

C. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

D. Duff Layer: A surface layer of soil, that is higher in nutrients from decayed turf cuttings,

leaves, twigs, and detritus.

E. Imported Soil: Soil that is transported to Project site for use.

F. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

G. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

H. Planting Soil: On-site soil, imported soil, or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

I. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

J. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

K. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.

2. Include test data substantiating that products comply with requirements.

3. Include sieve analyses for aggregate materials.

4. Material Certificates and Laboratory Testing Results: Submit within 4 weeks of Notice to Proceed: For each type of soil amendment and fertilizer,

organic soil amendment before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.
b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

1) Agricultural soil analysis results performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils

d. Organic Soil Amendments

1) Analysis of organic soil amendments by a qualified testing agency.

2) Results of organic soil amendment tests conducted within 120 days prior to delivery date to the project site.

3) Grain size analysis results performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.

4) Agricultural soil analysis results performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.

5) Compost: Submit the past 3 inspection reports from the local CalRecycle enforcement agency verifying compliance with specified Title14 requirements.

B. Samples: For bioretention soil and each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.7 INFORMATIONAL SUBMITTALS

A. Pre landscape construction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

B. Field quality-control reports.

1.8 PRE- LANDSCAPE CONSTRUCTION TESTING

A. Pre Landscape construction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses for stockpiled on-site soil after being re-placed and prior to planting.

1. Have testing agency identify and label samples and test reports according

to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Project Inspector under the direction of the testing agency.

1. Number and Location of Samples: Minimum of three per acre for turf areas, and three total for shrub areas, representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.

2. Procedures: A representative sample shall consist of a composite of multiple sub-samples taken from the area under investigation, combined and then submitted.

Discard the top inch of soil to avoid including debris that might contaminate the sample. Equipment for sampling may be a soil sampling tube, soil auger, spade, shovel, and/or trowel. Soil sampling tools shall be clean and not rusty.

Do not sample if the soil is muddy, or excessively wet. Seal soil samples shall be sealed in airtight plastic bags.

3. Depth of Core Samples Soils:

On-Site Soils: In place at grade – 8”-10” depth (to be redone if the amending was not verified by the site IOR or Landscape Architect.

4. Labeling

a. On-Site Soils: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

5. Packaging and Shipping: Ship samples as directed by testing agency.

6. Reference Plant List: Provide a list of plants proposed for installation as indicated on the Drawings, and a copy of these specifications, to the testing agency.

C. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by the following method according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical

Methods."

D. Chemical Testing:

E. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA.

F. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

G. Recommendations: Based on the test results, testing agency shall provide interpretation of data and written recommendations for soil treatments, soil amendments to be incorporated, and required leaching, to produce satisfactory planting soil suitable for healthy, viable plants as indicated on Drawings.

Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients. Include results of the soil texture and percent by dry weight of soil organic matter. Include recommendations for remediation of phytotoxicity elements and deleterious materials. Include amount and length of time to perform leaching operations, if required.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight or volume per 1000 sq. ft. for 6-inch depth of soil and in weight or volume per cu. yd. of backfill mix.

Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight or volume per 1000 sq. ft. for 6-inch depth of soil and in weight or volume per cu. yd. of backfill mix.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Do not move or handle materials when they are wet or frozen.

4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 LANDSCAPE FINISH GRADING

Site topsoil material - No import soil unless approved by Landscape Architect.

2.2 This article is organized around two soil sources used to produce planting soils.

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. On-Site Planting-Soil: **On-site soil, with the duff layer (top 6" of soil stockpiled after removal of the athletic field turf)**, if any, retained; modified to produce viable planting soil. ***Landscape Architect is to be sent pictures of the stockpile.***

1. Amended Soil Composition: ***For bidding purposes*** blend unamended on-site soil with the following soil amendments and fertilizers in the following quantities to produce planting soil (actual quantities will be determined by soils test recommendations):
   a. Ratio of Loose Compost to Soil: 4 cu. yd. per 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   b. Weight of Soil Sulfur: 20 lbs. per 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   c. Weight of Iron Sulfate: 20 lbs. 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   d. Weight of Agricultural Gypsum: 100 lbs. per 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   e. Weight of Superphosphate: 8 lbs. per 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   f. Weight of Commercial Fertilizer: 200 lbs. per 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   g. Weight of Slow-Release Fertilizer: 20 lbs. per 1000 sq. ft. per 6 inches, or part thereof, of amended soil depth.
   h. Sand as required to increase infiltration rate to acceptable levels.

2. Additional Properties of on-site soil after amending:
   a. Soil reaction of pH 6 to 8 as measured in the saturation extract.
   b. Percent Organic Matter By Dry Weight
   c. Salinity: The salinity range measured in the saturation extract (Method

3a, USDA Handbook Number 60) shall be 3.0 or less dS/m. If calcium and sulfate ions both exceed 20 milliequivalents per liter in the saturation extract, the maximum salinity shall be 5.0 dS/m.

d. Chloride: The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).

e. Boron: The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).

f. Sodium Absorption Ratio (SAR): The maximum SAR shall be 5 measured per Method 20b, USDA Handbook Number 60.

g. Carbon:nitrogen ratio shall be less than 20:1

h. Aluminum: Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 5 parts per million.

i. Calcium Carbonate Content: Free calcium carbonate (limestone) shall not be present.

j. Phytotoxic Constituent, Herbicides, Hydrocarbons*:* Germination and growth of monocots and dicots shall not be restricted more than 10 percent compared to the reference soil. Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 0.5 mg/kg dry soil measured per EPA Methods No. 8020.

k. Heavy Metals: The maximum permissible elemental concentration in the soil shall not exceed the following:

l. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

3. Unacceptable Properties: Clean soil of the following:

a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones exceeding 1/2-inch in any direction, roots, plants, sod, clay lumps, and pockets of coarse sand.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.

2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.

3. Form: Provide lime in form of ground calcitic limestone or ground mollusk shells.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur, and conforming to requirements of the California Food and Agricultural Code.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well decomposed, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Compost shall be produced at a facility inspected and regulated by the Local Enforcement Agency for CalRecycle.

2. Comply with Title14 requirements of the Process to Further Reduce Pathogens (PFRP), Fecal coliform and Salmonella testing and pathogen and EPA, 40 CFR 503 regulations

3. Feedstock limited to leaves and plant parts only; includes straw and alfalfa.

4. Mushroom, manures, peat mosses, green waste and food waste composts are acceptable.

5. Composted wood products are conditionally acceptable (stable humus must be present). Wood products based on redwood or cedar are not acceptable. Wood derivatives, including sawdust and chipped construction waste are not acceptable.

6. Sewage sludge and animal waste are not acceptable.

7. Compost shall have a dark brown color and a soil like odor.

8. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.

9. Comply with Title14 requirements of the Process to Further Reduce Pathogens (PFRP), Fecal coliform and Salmonella testing and pathogen and EPA, 40 CFR 503 regulations.

10. Particle Size: The maximum particle size shall be 0.5-inch

11. Calcium carbonate shall not be present if to be applied on alkaline soils.

12. The salt content shall be less than 6 millimho/cm @ 25° C. (ECe less than 6) in a saturated paste extract.

13. Additional Properties:

Property	**Method**	**Requirement**
pH, Units	Saturation Paste	5.5 to 8
Soluble-Salt Concentration		Less than 5 dS/m
SAR		Less than 5
EC, dS/m	Saturation Extract	0 to 10
Boron, ppm	Saturation Extract	less than 1
Silicone Content (Acid insoluble ash)		Less than 50%
Moisture content by weight, %	Gravimetric	35-55%
Bulk Density, lbs/cubic yard		500 to 1100
Organic Matter, % of Dry Weight	Loss on Ignition	50-65%
Carbon to Nitrogen Ratio		Less than 20:1
Zinc (Zn)		Less than 2,500 ppm
Pathogen		
Salmonella	Title 14	< 3 MPN per 4 gms
Fecal Coliform		<1000 MPN per 1 gm
Physical contaminants		
Plastic Metal and Glass, %> 4mm	% by Weight	< 1
Sharps, % > 4mm	% by Weight	0

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

2.5 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, water soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, minimum 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Nutri-Pak
2) Or Equal.

C. Slow-Release Fertilizer: Packet fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Nutri-Pak
2) Or Equal.

D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in this section.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 REPLACING STOCKPILED TOPSOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix **unamended stockpiled on-site soil** with amendments on-site to produce required planting soil. Do not apply materials or till if on-site soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Cross rip subgrade to a minimum depth of 3 inches. Remove stones, sticks, roots, rubbish, and other extraneous matter 1-inch and larger in any dimension, and legally dispose of off District's property.

C. Compaction: Compact each blended lift of planting soil to 75 to 80 percent of maximum Standard Proctor density according to ASTM D 698, **except where a different compaction value is indicated on Drawings for PIP rubber surfacing or synthetic turf**.

D. Leaching: Leach amended soils with a minimum of 6” of water over a 2 week period or as determined by the soils test recommendations to reduce SAR, ECE, and Sodium to acceptable levels as determined by the soils test recommendations.

3.3 FINISH GRADING

A. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Rake out all rocks and material 1/2-inch size and larger.

B. Finish grades shall be as indicated on the Drawings.

C. Finish grades shall be measured at the top surface of surface materials.

D. Molding and rounding of the grades shall be provided at all changes of slope.

E. Take every precaution to protect and avoid damage to new and existing sprinkler heads, irrigation lines, and other underground utilities during grading and conditioning operations.

F. Finish grades shall be acceptable to Project Inspector before planting operations begin.

G. Finish grade shall ensure positive drainage of the site with all surface drainage away from buildings, other structures, and walls with flow towards storm drains and catch basins.

H. Planting surfaces shall be graded with no less than 2 percent surface slope for positive drainage.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform the following tests and inspections.

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft of in-place soil or part thereof.

B. Soil will be considered defective if it does not pass tests and inspections.

C. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.5 PROTECTION

A. Protection Zone: Identify protection zones according to Section 01 56 39 "Temporary Tree and Plant Protection."

3.6 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off District's property unless otherwise indicated.

END OF SECTION

SECTION 329300 - PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The general provisions of the Contract, including the General Conditions and Special Conditions apply to work specific in this Section.

1.2 SUMMARY

The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of all Landscape Planting work as indicated on the Drawings, or as reasonably implied, or as designated herein, including, but not limited to, the following:

Protection of all existing plant material to remain.
Weed abatement.
Preparation of all planting holes.
Furnishing and installation of all plant materials unless otherwise noted.
Staking and tying trees.
Watering of all landscape areas.
Providing plant establishment (30 days).
Providing landscape maintenance (90 days).
Clean-up and weeding of all landscape areas.

1.3 CONTRACT DOCUMENTS

Shall consist of specifications, general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.4 RELATED WORK SPECIFIED ELSEWHERE

Section 015639	Temporary Tree and Plant Protection
Section 312000	Earthwork (trenching/backfilling not specified in this Section)
Section 328400	Irrigation system
Section 329113	Soil Preparation
Section 334100	Subdrainage (for below-grade drainage of play areas.)

1.5 QUALITY ASSURANCE

A. The Contractor shall provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with the type of materials being installed and the proper materials and methods for their installation, and who shall direct all work performed under this Section. The installing crew shall have a minimum of 3 years of experience, field supervisors a minimum of five years.

B. All plants and planting material shall meet or exceed the specifications of Federal, State and County laws requiring inspection for plant disease and insect control. Quality and size shall conform at a minimum with ANSI Z60.1 American Standard for Nursery Stock, most current edition, ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts, and California Department of Agriculture regulations.

C. The Applicator of all weed control materials shall be licensed by the State of California as a Pest Control Operator and a Pest Control Advisor in addition to any subcontractor licenses that are required.

D. All materials and methods used for Weed Abatement must conform to Federal, State, and Local Regulations.

1.6 VERIFICATION OF FIELD CONDITIONS

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work and shall immediately inform the Landscape Architect of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Landscape Architect.

B. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by District or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify District Construction Manager no fewer than seven business days in advance of proposed interruption of water service.

2. Do not proceed with interruption of water service without District Construction Manager’s written permission.

3. Obtain District Construction Manager’s written approval of exact length of time for each shut-off or work session.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated:

D. When it is necessary to plant trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.7 PERMITS AND REGULATION

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Landscape Architect in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

1.8 COORDINATION

A. Coordination with Turf Areas: Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

(1) When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.9 PROTECTION OF WORK, PROPERTY AND PERSON

The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.10 SUBMITTALS

A. Materials lists: Within forty-five (45) days after award of the Contract, submit via electronic delivery a complete LIST of all materials proposed to be furnished and installed under this Section, demonstrating complete conformance with the requirements specified.

(1) Materials list shall include the weed control materials and quantities per acre intended for use in controlling the weed types prevalent and expected on the site.

(2) Plant Material:

1. The Owner's Representative may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.
2. Plant Selection: The Owner's Representative reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Owner's Representative, the agreed upon remedy

may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense.

3. The Owner's Representative may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.
4. Corrections are to be undertaken at the nursery prior to shipping.
5. The Contractor shall bear all cost related to plant corrections.
6. All plants that are rejected shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.
7. Submit to the Owner's Representative, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.
8. Trees shall be purchased from the growing nursery. Re-wholesale plant suppliers shall not be used as sources unless the Contractor can certify that the required trees are not directly available from a growing nursery. When Re-wholesale suppliers are utilized, the Contractor shall submit the name and location of the growing nursery from where the trees were obtained by the re-wholesale seller. The re-wholesale nursery shall be responsible for any required plant quality certifications.
9. Plant Photographs: Include clear color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Stock photos of plant materials will not be acceptable for submittals, photos must be of actual plant materials at the nursery. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery
10. The Contractor shall require the grower or re-wholesale supplier to permit the Owner's Representative to observe the root system of all plants at the nursery or job site prior to planting including random removal of soil or substrate around the base of the plant. Observation may be as frequent and as extensive as needed to verify that the plants meet the requirements of the specifications and conform to requirements.

(3) Plant substitutions for plants not available:

Submit all requests for substitutions of plant species, or size to the Landscape Architect, for approval, prior to purchasing the proposed substitution. *Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material.* Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the

same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

(4) JPG or PDF Samples from the nursery of each product and/or material where required by the specification or legend for Landscape Architect review and approval.

B. Certificates: Deliver all certificates via email to the Landscape Architect upon delivery to job site. Include:

(1) Organic Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

(2) Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.

(3) Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

(4) Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

1.12 CHANGES IN THE WORK

A. The Owner's Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.13 CORRECTION OF WORK

The Contractor, at their own cost, shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest as possible time that can be coordinated with other work and seasonal weather demands.

1.14 APPROVALS

All irrigation system work shall be inspected for recommended approval by the Landscape Architect prior to start of any work in this section.

1.15 PRODUCT HANDLING

A. Delivery and Storage:

(1) Deliver all items to the job site in their original containers, unopened, with all labels intact and legible at time of Landscape Architect's review.

(2) Bulk Materials:

a. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
b. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
c. Do not move or handle materials if they are wet.
d. Accompany each delivery of bulk materials with appropriate certificates.

(3) Immediately remove from the site all plants which are not true to name, shrubs that are not full and bushy, rootbound plants and trees, trees without clear leader where applicable, girdling root plant and trees, and all materials which do not comply with the specified requirements.

(4) Use all means necessary to protect plant materials before, during, and after installation and to protect the work and materials of all other trades.

(5) Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

a) Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
b) If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
c) Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

(6) Handle planting stock by root ball.

(7) Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

(8) Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying

(9) Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants

and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

a. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
b. Do not remove container-grown stock from containers before time of planting.
c. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the recommended approval of the Landscape Architect and at no additional cost to the City.

1.16 RESPONSIBILITY AND COORDINATION DURING WEED ABATEMENT

A. During Weed Abatement procedures, the Landscape Contractor is responsible for the erection of all signs and barriers required to prevent intrusion into the treated areas and to notify the public.

B. No material or methods used for Weed Abatement shall affect the landscape planting or hydroseed germination. No material or method shall render the job site unusable for more than ten (10) days from date of application.

1.17 PLANTING AROUND UTILITIES

1. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

2. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

3. Notification of dig-alert is required for all planting areas. The contractor is responsible for knowing the location and avoiding utilities. For dig-alert call underground service alert toll free 1-800-422-4133 two working days before beginning construction.

PART 2 - MATERIALS

All materials shall conform to the requirements of the Standard Specifications, except as modified herein.

2.1 NON-SELECTIVE HERBICIDES

Non-selective contact herbicide and/or non-selective systemic herbicides (as recommended by the Pest Control Advisor).

2.2 SELECTIVE HERBICIDES

Selective pre-emergent herbicides (as recommended by the Pest Control Advisor).

2.3 PLANT MATERIALS

A. Nomenclature: The scientific and common names of plants herein specified conform to industry standards. (Refer to list of plant materials on Drawings).

B. Labeling: Each group of plant materials delivered to the site shall be clearly labeled as to species and variety and nursery source.

C. Quality and Size:

(1) Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules and grading. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous, and free of insect infestations, plant diseases, sun scalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. All plants shall have normally well-developed branch system, with vigorous and fibrous root systems which are not root, pot bound, or have girdling roots. Containers will be inspected by removal of earth from the roots of not less than two plants or more than 2% of the total number of plants of each species or variety. Where container grown plants are from several sources, the roots of not less than two plants of each species or variety from each source will be inspected. In case the sample plants reviewed are found to be defective, the Landscape Architect may judge acceptability. Any plants rendered unsuitable for planting because of this review will be considered as samples and will be provided at the expense of the Contractor.

(2) The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock, or as specified in the special Conditions or Drawings. The minimum acceptable size of all plants measured before pruning with the branches in normal position, shall conform to the measurements, if any, specified on the Drawings in the list of plants to be furnished. Plants larger in size than specified may be used with the recommended approval of the Landscape Architect, but the use of larger plants will make no change in contract price. If the use of larger plants is recommended for approval, the ball of earth or spread of roots for each plant shall be increased proportionately.

(3) Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type pecified. Tree quality above the soil line shall comply with the project Crown Acceptance details and the following:

a. Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar pruned to a central and dominant leader. Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi stem, clump, or unique

selections such as contorted or weeping cultivars.

b. Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.

c. Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.

(1) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
(2) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
(3) The attachment of the largest branches (scaffold branches) shall be free of included bark.

d. Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks (fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).

(4) Trees shall have one central leader, depending on species. If the leader was headed, a new leader (with a live terminal bud) at least one-half the diameter of the pruning cut shall be present.

a. All trees are assumed to have one central leader trees unless a different form is specified in the plant list or drawings.

b. All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.

c. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.

(5) Plant quality at or below the soil line:

a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health. Root quality at or below the soil line shall comply with the project Root Acceptance details and the following:

b. The roots shall be reasonably free of scrapes, broken or split wood.

c. The root system shall be reasonably free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high

quality root system are not considered injuries.

d. A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.

1) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.

e. The root collar shall be within the upper 2 inches of the substrate/soil. Two structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.

f. The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.

1) Plant Grower Certification: The final plant grower shall be responsible to have determined that the plants have been root pruned at each step in the plant production process to remove stem girdling roots and kinked roots, or that the previous production system used practices that produce a root system throughout the root ball that meets these specifications. Regardless of the work of previous growers, the plant's root system shall be modified at the final production stage, if needed, to produce the required plant root quality. The final grower shall certify in writing that all plants are reasonably free of stem girdling and kinked roots as defined in this specification, and that the tree has been grown and harvested to produce a plant that meets these specifications.

g. At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

D. Rejection or Substitution: All plants not conforming to the requirements herein specified shall be considered defective, and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the contractor's expense. The plants shall be of the species, variety, size and condition specified herein or shown on the drawings. Under no condition will there be any substitution of plants or sizes for those listed on the accompanying plans, except with the expressed consent of the Landscape Architect.

E. Pruning: At no time shall the tree or plant materials be pruned, trimmed or topped prior to delivery, and any alteration of their shape shall be conducted only with the recommended approval and when in the presence of the Landscape Architect.

F. Protection: All plants at all times shall be handled and stored so that they are adequately protected from drying out, from wind burn, or from any other injury.

G. Right of Review: The Landscape Architect reserves the right to recommend approval or rejection at any time upon delivery or during the work, any or all plant material regarding size, variety or condition.

H. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.5 ROOT BALL PACKAGE OPTIONS

A. Container (including above-ground fabric containers and boxes) plants

(1) Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner's Representative.

(2) Provide plants shall be established and well rooted in removable containers.

(3) Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

2.6 SEED MIX

Seeds shall be fresh, clean, new crop seed. Conforming to Section 212-1.3 of the Standard Specifications. Seed shall be pre-mixed by mechanical mixer. Contractor to submit seed mix specifications from supplier, prior to purchase of seed.

A. Infield Area Turf Seed	Proportions by Weight
Rye, Bermuda Blend "Tif Sport" by West Coast Turf	100%

Seeding rate 12 lbs. per 1,000 square feet of pure live seed.
NOTE: *If hydroseeding is to occur October to March. Consult the Grower about when to seed.*

2.7 HYDROSEEDING AND HYDROMULCHING MATERIALS

A. Water: General precautions should be observed when drawing water from sources other than domestic water supply. Water must be free of impurities, excess chlorine, and salts. The use of purified water or filters may be required when directed. General precautions shall be observed when drawing water from sources other than irrigation main line.

B. Seed mix in accordance with the mix design indicated on the Drawings Seeds shall be fresh, clean, new crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances. Seed shall be pre-mixed by mechanical mixer. Contractor to submit seed mix specifications from supplier, prior to purchase of seed.

NOTE: *If hydroseeding is to occur October to March, apply Fescue Seed only. Consult the Landscape Architect about when to seed the Hulled Bermuda.*

C. Mulch Fiber: Conweb '2000' or equal, shall be produced from cellulose such as wood pulp or similar organic materials and shall be of such character that it will disperse into a uniform slurry when mixed with water. The fiber shall be of such character that when used in the applied mixture, an absorbent or porous mat, but not a membrane will result on the surface of the ground. Materials which inhibit germination or growth shall not be present in the mixture.

D. Binding Agent: Ecology Controls M-Binder or equal. Dry powder organic concentrate. Available from: Robinson Fertilizer Company (714) 632-9710.

E. Commercial Fertilizer: Gro-Power Hi-Nitrogen, 14-4-9
Chemical Analysis: Nitrogen 14% Phosphate 4%, Potash 9%, Sulfur 3%, Humus 30%, Humic acids 6%, Gro-Power bacterial "stimulator" included.
Physical Properties: Each bead contains the same 14-14-9(S) formulation in addition to humus and humic acids - a water soluble biodegradable binder is used to insure fast breakdown. Available from: Gro-Power (213) 245-6849 or (714) 750-3830.

2.8 SODDED TURF

A. Sod type and supplier in accordance with the type indicated on the Drawings. Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

2.9 MULCH

A. Organic Bark Mulch: COUNTRY CLUB BLEND from Agriservice, Oceanside.

2.11 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.12 TREE SUPPORTS

A. Trunk-Stabilization Materials:

(1) Upright Stakes: Rough-sawn, sound, new Lodgepole Pine or Douglas Fir cores with alkaline copper quaternary (ACQ) wood pressure-preservative treatment, no chromated copper arsenate (CCA) treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.

(2) Flexible Ties: Manufactured of virgin flexible vinyl meeting ASTM D-412 standards for tensile and elongation strength, black for ultraviolet resistance, manufactured with a double back locking configuration. Flexible ties shall elongate with tree growth while preventing damage to the tree.

2.13 MISCELLANEOUS PRODUCTS

A. Root Barrier: Black, molded, modular panels 24 inches high (deep), 85 mils thick, and with vertical root deflecting ribs protruding 3/4-inch out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors. Panels shall have an integrated, self-interlocking joining system that slide into each other.

(1) Manufacturers: Subject to compliance with requirements, provide products by DeepRoot Green Infrastructure, LLC, NDS Inc, Villa Root Barrier, Or Equal.

B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

C. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

(1) Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

(2) Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.

(3) Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

(4) Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by District Construction Manager and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Locate all existing underground utilities and obstructions prior to excavating. Bring to the attention of the District Construction Manager any interferences found.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

(1) Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.

(2) Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Unacceptable Materials: Remove from soil all concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

D. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architects acceptance of layout before excavating or planting. Make minor adjustments as required.

E. Prior to excavating planting holes, locate underground utilities and structures in the area of excavations. Damage to existing utilities shall be the responsibility of the Contractor.

3.2 ADVERSE WEATHER CONDITIONS

No planting shall take place during extremely hot, dry, windy, or freezing weather.

3.3 WEED ERADICATION

A. Prior to the installation of the irrigation system, all weed growth shall be removed within the areas designated to be cleared and grubbed. Refer to plans for limit of work.

(1) If in the opinion of the Pest Control Advisor, perennial grasses and weeds existing in the planting areas will require control prior to removal, spray these areas per Pest Control Adviser's recommendations. Allow herbicide to kill all weeds. Rake or hoe off all dead weeds to a depth of one to two inches (1" to 2") below the surface of the soil. Physically remove all weeds from the site.

B. Upon completion of the irrigation system and rototilling of soil amendments into the soil and immediately preceding the installation of plant material, perform weed abatement as follows, and per Pest Control Advisors recommendation.

(1) Apply Sulfate of Ammonia at the rate of five pounds (5 lbs.) per one thousand square feet (1,000 sf.) to all planting areas.

(2) Irrigate area for fourteen (14) consecutive days, to germinate existing weed seeds.

(3) Apply by spray a non-selective herbicide to eradicate all existing weeds. Do not irrigate for seven (7) days after application.

(4) Remove weeds after herbicide has had time to sufficiently kill. Remove all dead weeds by rake or hoe to a depth of one to two inches (1" to 2") below the surface of the soil. Remove all weed residue and top growth and dispose of in a legal manner.

3.4 TREE AND SHRUB INSTALLATION

A. All irrigation work shall have been reviewed by the Landscape Architect prior to beginning any planting.

B. Installation of all plant material shall be in accordance with the details on the Planting Plans.

C. Locations for plants and outlines of areas to be planted shall be marked on the ground by the Contractor before any plant pits are dug. All such locations shall be reviewed by the Landscape Architect and Owner/Agent. If an underground construction or utility line is encountered in the excavation of planting areas, notify Landscape Architect so that other locations for planting may be selected.

D. Excavation for Planting:

(1) Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.

(2) Protect all areas from excessive compaction when trucking plants or other material to the planting site.

(3) All excavated holes shall have vertical sides with roughened surfaces and shall be of a size that is at least two times the width and depth of the original plant container. The holes shall be, in all cases, large enough to permit handling and planting without injury or breakage to the roots or root ball.

(4) Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

(5) Drainage: Notify District Construction Manager if subsoil conditions evidence water seepage or retention in tree or shrub planting pits.

E. percolation test pits

(1) Locate and prepare five (5) minimum percolation test pits where indicated on the Drawings, and as described herein.

(2) Excavate the pits as described in Part 2: Tree and Shrub Excavation, remove all loose material, and fill the pits with six inches (6") of water. After 12 hours refill with the same amount of water. Six hours after the second filling, inspect the pits with the District Construction Manager and document locations where water remains in the pit.

(3) If percolation problems occur, provide means and methods for correcting said problems. Planting operations at the locations identified shall be suspended as necessary or as directed by the District Construction Manager.

F. Planting:

(1) No planting shall be done in any area until the area concerned has been satisfactorily prepared in accordance with these Specifications.

(2) No more plants shall be distributed in the planting area on any day than can be planted and watered on that day.

(3) Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

(4) Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break. Plant will not be accepted if the rootball is broken or cracked, either before, during or after the installation process.

(5) Permitted root ball packages and special planting requirements

Container (includes boxed and above-ground fabric containers) plants

1) this specification assumes that most container plants have significant stem girdling and circling roots, and that the root collar is too low in the root ball.
2) remove the container.
3) perform root ball shaving as defined in installation of plants: general above.
4) remove all roots and substrate above the root collar and the main structural roots according to root correction details so root system conforms to root observations detail.
5) remove all substrate at the bottom of the root ball that does not contain roots.
6) using a hose, power washer or air excavation device, wash out the substrate from around the trunk and top of the remaining root ball and find and remove all stem girdling roots within the root ball above the top of the structural roots.

(6) Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled. Do not straighten plants by pulling the trunk with guys.

(7) After the water settling of the plant has completely drained, Nutri-Pak fertilizer packets shall be placed as indicated below. Set the packets to be used with each plant on the top of the root ball while the plants are still in their containers so the required number of packets to be used in each hole can be easily verified:

2 packets per one gallon container.
3 packets per five gallon container.
5 packets per fifteen gallon container.
7 packets per 24" box container.
9 packets per 36" box container.
12 packets per 48” box container.

The remainder of the hole shall then be backfilled.

(8) After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least two inches (2") of water. Basins shall be of a size suitable for the individual plant. In no case, shall the basin for a fifteen (15) gallon plant be less than four feet (4') in diameter; a five (5) gallon plant less than three feet (3') in diameter; and a one (1) gallon plant less than two feet (2') in diameter. The basins shall be constructed of amended backfill material. Rake out basins prior to planting lawn areas or groundcover areas.

G. Pruning: Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to compensate for loss of roots during transplanting, but never to exceed one-third (1/3) of the branching structure. Upon recommended approval of the Landscape Architect, pruning may be done before delivery of plants, but not before plants have been reviewed and recommended for approval. Cuts over three quarters of an inch (3/4") in diameter shall be painted with an approved tree wound paint.

H. Staking and Tying:

(1) Support stakes tall enough to support the particular tree shall be driven thirty-six inches (36") into the soil. Stake shall be placed on the leeward side of the tree from the most troublesome direction, refer to details on Drawings.

(2) Ties shall be placed as low on the trunk as possible but high enough so the tree will return to upright after deflection.

(3) To find the proper height for tie locations, hold the trunk in one hand, pull the top to one side and release. The height at which the trunk will just return to the upright when the top is released is the height at which to attach the ties.

(4) Ties are to form a loose loop around the tree trunk so that the trunk cannot work towards the support stakes.

I. Root-barrier installation

(1) Install root barrier where trees are planted within 120 inches (10 feet) of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

(2) Align root barrier vertically with bottom edge angled at 20 degrees away from the paving or other hardscape element, and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

(3) Install root barrier continuously for a distance of 10 feet in each direction from the tree trunk, for a total distance of 20 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.

a) Position top of root barrier 1/2-inch above adjacent finish grade.

b) Overlap root barrier a minimum of 12 inches at joints.

c) Do not distort or bend root barrier during construction activities.

d) Do not install root barrier surrounding the root ball of tree

3.5 HYDROSEED TURF AND GROUND COVER INSTALLATION

Remove existing turfgrass, vegetation, surplus soil and waste material, and legally dispose of them off District's property. Do not mix into surface soil. Grade smooth all surfaces to be seeded. Soil surface shall be three-quarters inch (3/4") below adjacent pavement after settling. Roll lightly and fill in all soil depressions. All areas shall slope to drain. Remove all rocks one inch (1") or larger from the top two inches (2") of soil.

Soil shall be level, smooth and moist prior to hydroseeding.

The seed bed shall be reviewed by the Landscape Architect to determine its suitability prior to planting. The Contractor shall obtain such recommended approval prior to seeding grass. No seeding shall be performed until all other construction operations have been completed, except by authorization of the Landscape Architect.

Mixing of hydromulch slurry shall be performed in a tank with a built-in continuous agitation and recirculation system of sufficient operating capacity to produce a homogeneous slurry of mulch fiber, binding agent, fertilizer and water as specified in this Section 2.09, in the designated unit proportions:

Mulch Fiber	2,000 lbs. per acre
Seed Mix	As specified in this document.
Binding Agent	100 lbs. per acre
Fertilizer-Gro-Power Hi-Nitrogen	250 lbs. per acre
Water	3,000 gallons per acre

With agitation system operating at part speed, water shall be added to the tank, good recirculation shall be established. Materials shall be added in such a manner that they are uniformly blended into the following sequence.

When tank is 1/3 filled with water:
Add binding agent, 1/2 acre requirement
Add 3 - 50 lbs. bales of fiber
Add seed, 1/2 acre requirement
Add fertilizer, 1/2 acre requirement

When the tank is 1/2 filled with water:
Agitate mixture at full speed.

Before tank is 3/4 filled with water:
Add 7 - 50 lbs. bales of fiber.

As tank becomes filled with water:
Add remaining requirements.

Slurry distribution should begin immediately.
Area to be hydroseeded shall be moistened to a depth of six inches (6") just prior to application.

Application: Hydromulched slurry shall be applied under high pressure, evenly and result in uniform coat on all areas to be treated. Care shall be exercised to assure that plants in place are

not subjected to the indirect force of an application. Slurry shall be immediately removed from walks, structures, etc. that are inadvertently sprayed.

3.6 SODDED COOL SEASON TURF

Turf grass shall be planted by sod laying, as indicated per plan. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is muddy.

Sodding - irrigate areas to be sodded prior to installation. Moisture shall be uniformly present to a depth of 2". Sod shall be installed within one day of delivery, rolls shall be placed in shaded areas prior to installation. Lay sod to form a solid mass with tightly fitted joints. Maximum separation: 1/8". Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Within 1 week of laying sod, work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass

Following installation, irrigate turf areas thoroughly to provide even moisture penetration. Roll all sod prior to beginning installation within two (2) hours - prior to beginning irrigation, sod shall be uniformly smooth in appearance and shall be flush with the finished grade of all walks, curbs, etc.

No earlier than two weeks and no later than 4 weeks after completion of sodding operations, fill in any depressions to form a uniformly smooth turf surface free of depressions, pits, etc. with soil or fine sand.

Anchor sod on slopes exceeding 6:1 with steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod

Maintenance - three (3) weeks after installation of turfgrass, areas shall be mowed regularly at intervals not exceeding once per week. Mowing shall be done with sharp, well adjusted mowers or cut more that half the existing top growth in one mowing. Mowing heights shall be 2" to 2 1/2", during hot weather seasons never less than 2" and shall be 1 1/2" TO 2" during cool weather seasons. Turfgrass areas that do not properly grow shall be resodded as necessary. At the termination of the maintenance period all turfgrass areas shall be completely covered, leaving not barren spots larger than three inches (3") x three inches (3").

3.7 WATERING

Apply water to all planted areas during operations and thereafter, until acceptance of the work.

Immediately after planting, apply water to each shrub by means of a hose. Apply water in a moderate stream in the planting hole until the material about the roots are completely saturated from the bottom of the hole to the top of the ground.

Apply water in sufficient quantities and as often as seasonal conditions require to keep the planted areas sufficiently moist at all times, well below the root system of grass and plants.

All turf and groundcover areas shall be kept damp at all times and irrigation should be adjusted accordingly. This normally would involve four (4) to six (6) watering periods daily, each watering period (ON) regulated to just dampen the mulch without creating run off.

3.8 PLANTING AREA MULCHING

A. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 2 inches of trunks or stems.

Do not apply organic mulch in planter areas that exceed 3:1 slope.

3.9 ESTABLISHMENT AND MAINTENANCE PERIOD

The Contractor shall continuously maintain all areas involved in this contract during the progress of the work and during the establishment and maintenance period until final acceptance of the work by the City.

A. Plant establishment period: The contractual establishment period shall be for no less than thirty (30) continuous calendar days. The contractual establishment period begins on the first day after all planting in this project is completed and accepted and the planted areas are brought to a neat, clean and weed free condition.

(1) Any day upon which no work will be required, as determined by the Landscape Architect, will be credited as one of the plant establishment working days regardless of whether or not the Contractor performs plant establishment work.

(2) Any day when the Contractor fails to adequately maintain plantings, replace unsuitable plants or do weed control or other work, as determined necessary by the Landscape Architect, will not be credited as one of the plant establishment working days.

(3) In order to carry out the plant establishment work, the Contractor shall furnish sufficient men and adequate equipment to perform the work during the plant establishment period.

(4) Improper maintenance or possible poor condition of any planting at the termination of the scheduled establishment period may cause postponement of the final acceptance of Plant Establishment. Contractor shall bear all costs for extension of the Plant Establishment period.

B. Plant Maintenance Period: The contractual maintenance period shall be no less than ninety (90) continuous calendar days and, shall begin at the acceptance of the Plant Establishment Period.

(1) All areas shall be kept free of debris, and all planted areas shall be weeded at intervals of not more than ten (10) days. Watering, trimming, fertilization, spraying and pest control, as may be required, shall be included in the maintenance period. Maintenance shall include gopher control.

(2) Post fertilize all turf areas at the end of every 30 days (of maintenance) at the rate of five pounds (5 lbs.) per one thousand square feet (1,000 s.f.) using ammonium sulfate, evenly applied and thoroughly watered in. Post fertilize all groundcover areas at the end of every thirty (30) days (of maintenance) at the rate of thirty pounds (30 lbs.) per one thousand square feet (1,000 s.f.), using 5-3-1 Gro-Power. For the final feeding of all areas, use 12-8-8 Gro-Power Controlled

Release Nitrogen at the rate of thirty pounds (30 lbs.) per one thousand square feet (1,000 s.f.).

(3) Mowing of turf will commence when turf grass has reached a height of two inches (2").

Mow Hybrid Bermudagrass to a height of 1/2 to 1-inch.
Mow Hybrid Fescue to a height of 1-1/2 to 2 inches.

Mowing will be at least weekly after the first cut. Turf must be well established and free of bare spots and weeds to the satisfaction of the Landscape Architect prior to final acceptance by the City. Excess grass clippings, as determined by the Landscape Architect, shall be picked up and removed from the site and premises.

Edging: Edging of sidewalks, driveways, curbs, and other paved surfaces, around gardens, plant beds, and other cultivated areas is to be performed to prevent the encroachment of surrounding vegetation and to maintain a clearance of 1/4-inch from paved areas. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven, and rough cutting. Edging shall be performed at the frequency established for each maintenance level and on the same day that mowing is accomplished.

(4) The Contractor shall maintain the irrigation systems in a like new operating condition; adjusting head heights and spray arcs as necessary. The Contractor is responsible for proper watering of all planting areas, for providing any necessary supplemental water as may be required, and shall replace any material damaged due to improper moisture.

(5) During the maintenance period, the Contractor shall be responsible for maintaining adequate protection for all planting areas. Any damaged areas shall be repaired and any plant materials replaced at the Contractor's expense.

(6) The Contractor's maintenance period will be extended past ninety (90) days if these provisions are not filled.

3.10 GUARANTEE AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by District Construction Manager.

(1) Submit details of proposed pruning and repairs.

(2) Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.

(3) Replace plant materials that cannot be repaired and restored to healthy, long term full-growth status, as determined by District Construction Manager, within 14 days after notification, at no additional cost to the District.

B. Remove and replace plant materials that are more than 25 percent dead or in an unhealthy condition before the end of the maintenance period or are damaged during construction operations that District Construction Manager determines are incapable of restoring to normal growth pattern, at no additional cost to the District.

(1) Provide new plant materials of same size as those being replaced.

(2) Species of Replacement Plant Materials: Same species, variety, and/or cultivar being replaced.

3.11 REVIEWS

A. Normal progress reviews shall be requested from the Landscape Architect at least forty-eight (48) hours in advance of an anticipated inspection. A review will be made by the Landscape Architect on each of the steps listed below. The Contractor will not be permitted to initiate the succeeding steps of work until he has received written recommendation of approval to proceed by the Landscape Architect.

(1) Spotting of all trees and minor adjustments prior to planting.

(2) Review and start of establishment period.

(3) Final acceptance of project ninety (90) day maintenance.

3.12 LONG TERM MAINTENANCE

A. General

(1) All areas shall be kept free of debris and weeded at intervals of not more than 10 days. Watering, trimming, fertilizing, spraying and pest control, as may be required shall be included in the maintenance contract.

(2) Post fertilize all turf areas at the end of every 30 days at a rate of 5 lbs./1,000 sq. ft. using ammonium sulfate. Evenly and thoroughly water in. Post fertilize all ground cover areas at the end of every 30 days at a rate of 30 lbs./1,000 sq ft using 5-3-1 Gro-Power. *Grevillea plants are the exception where they shall receive no phosphorus.*

B. Trees

(1) Soil surface around the drip line of all trees is to be protected from compaction from vehicular traffic and pedestrian overuse.

(2) Injury around the drip line of the tree canopy is to be avoided. No digging, grading, soil filling, addition of concrete will occur in this area.
The first four (4) years after planting, mulch should be maintained around the rootball to create a healthy root environment, fertilization should be maintained to aid in the healthy growth of the trees, and if necessary, pruning should occur in later winter or early spring (before tree buds) by a licensed arborist.

(3) From year five (5) and beyond, mulching at the tree base should be maintained, heavy pruning should be avoided (except to remove dead or diseased branches), and pest management should be conducted by a licensed arborist.

(4) After one (1) year of watering, bubblers on all oaks transplanted from wild are to be turned off.

C. Shrubs / Vines

(1) All shrubs are to be left in their natural form, no pruning or shearing shall occur (except when plants are labeled as a hedge on the original design plans). All dead limbs or flower heads are to be removed via hand clippers.

(2) Dead plant material is to be replaced with like material within a month, minimum size 5 gallon.

(3) All ornamental grasses and dietes that become unsightly due to brown blades are to be trimmed in later winter or early spring (Feb-Mar) to a height of about twelve (12) inches. *Lomandra are the exception, no pruning of this plant is to occur.*

D. Mulch

(1) Mulch is to be replenished every six (6) months with like material to achieve a three inch (3") layer. No debris or construction material is to be part of the organic mulch.

D. Turf

(1) Aeration of bermuda grasses

(a) Bermuda turf areas should be aerated every year depending on the soil type and turf type. Clay soils will require aeration 2x per year, sandy soils 1x per year.

(b) Aeration times should be early fall or late spring to give the turf time to regenerate while the weather is still warm

(c) Water turf area well before aerating and make sure no weed problems are present.

(2) Dethatching of turf grass

(a) Dethatching should be done when the thatch has reached ½" or greater. Thatch is the brown layer between the soil and grass blades.

(b) Bermuda grasses may need it yearly depending on watering, fertilizing schedules, and weather. Fescues and Blues may need it every few years.

a) Mow the turf one inch (1") shorter than you normally would before running a dethatcher through it.

(d) Dethatching should be done in early fall or later spring to all the turf time to regenerate while the weather is still warm.

END OF SECTION

SECTION 331100 – WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements: Provide water distribution system, complete, as indicated on the Drawings or inferable therefrom and/or as specified in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Product Data: Submit copies of manufacturer's specifications and installation instructions for each material. Include certification or other data verifying compliance with required characteristics. Indicate by transmittal form that copy of each has been distributed to the Installer.

B. Shop Drawings: Submit layout and shop drawings as required under Section Submittals. Include details of reinforced concrete structures.

C. Test Reports: Submit certified Test Reports showing compliance of the following items in accordance with Section General Conditions.

1. Laboratory test for bedding and trench stabilization materials.
2. Concrete design mix.
3. Compression tests.
4. Water Test Reports: Submit results of water sample tests by State or local health authorities

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
3. The Contractor shall have one copy of the Standard Specifications at the job site.
4. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

F. California Health and Safety Code:

1. Per Section 116875 subparagraphs a through d, effective January 1, 2010 as specified in SB 1334, Stat. 2008, c.580 – all domestic water systems have to use lead-free pipes, fixtures, solder or flux.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and or Owner's representative not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect and or Owner's representative written permission.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to materials during loading, transportation, and unloading. Store equipment with moving parts off ground on platforms or skids.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE AND FITTINGS

A. **PVC, Schedule 40 (NPS 1/8 to NPS 3 ½):** ASTM D 1785. Suitable for potable water distribution and manufactured in compliance with NSF Standards.

1. Fittings: PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. **PVC, AWWA Pipe (NPS 4 to NPS 12)**: AWWA C900, Class 200 DR 14, with bell-and-spigot or double-bell ends.

1. PVC to PVC Fittings: Push-on-Joint, PVC Fittings, ASTM 3139, with elastomeric gasket bell ends, conforming to ASTM D2122 for bell measurements.

2. PVC to Metal Fittings, Valves, and Accessories: Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands and Gaskets: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.3 VALVES

A. AWWA, UL/FM Cast-Iron, Gate Valves:

1. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509 and UL/F.M. approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 200 psig.
b. End Connections: Flanged, push-on rubber gasketed, or mechanical joint, as required.
c. Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately five-inch diameter barrel. Fabricate valve box cover to fit snugly to prevent displacement by traffic.

1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

B. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve with tamperproof electrical supervisory switch for connection to the fire alarm control panel system.

2.5 VALVE APPLICATION

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

1. Where specific valve types are not indicated, the following requirements apply:

a. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated, gate valves with valve box.
b. Underground Valves, NPS 4 and Larger, for Vertical-Type Indicator Posts: UL/FM, Cast-iron, nonrising-stem gate valves with indicator post.

2.6 BOLTS, NUTS, AND WASHERS

A. Bolts and nuts for flanged valves, flanges, and fittings shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts. For grooved-end fittings, bolts shall be Type 316 stainless steel and conform to ASTM F-503 or ASTM A-183 and have a minimum tensile strength of 110,000 psi.

B. Washers shall be provided for each nut, shall be of the same material as the nut, and shall be installed adjacent to the nut, between the nut and the flange.

C. The length of each bolt or stud shall be such that between 1/4 inch and 1/2 inch will project through the nut when drawn tight.

2.7 CORROSION-PROTECTION ENCASEMENT FOR PIPING

A. Polyethylene Encasement for Underground Ductile-Iron Pipe and Fittings: Polyethylene encasement of eight mils thickness shall conform to AWWA C105. Joint tape shall be self sticking PVC or polyethylene, eight mils thick.

B. Fusion-Bonded Epoxy Coatings for Ductile-Iron and Gray-Iron Fittings: Epoxy coating shall conform to AWWA C116.

2.8 WATER METERS

A. Water meter(s) indicated on drawings shall be installed by the local water purveyor for the area, unless noted otherwise.

2.9 FIRE HYDRANTS

A. Before procurement, verify approval has been issued by the Fire Department having jurisdiction.

B. Wet-Barrel Fire Hydrants: AWWA C503 or UL 312, one NPS 4 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have 150-psig minimum working-pressure design.

1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
2. Operating and Cap Nuts: Pentagon, one and one-half inches point to flat.
3. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.

C. Combined length of bury and extension shall be as indicated. Where not indicated, install top of hydrant flange three inches above finished surface.

D. Exterior Finish: "O.S.H.A. safety yellow" Ameritone 719 or approved equal after receiving a prime coat.

E. Break-Away Spools: Ductile iron break-away spools shall be provided for each hydrant installation. Each spool shall have a scored groove placed circumferentially around the spool near the hydrant end of the spool. The score shall be placed above-grade. Only one score shall be made in the hydrant break-away spool piece. Spool flanges shall be a 6-hole pattern to match both hydrant and bury.

F. Break-Away Bolts: Cadmium plated Type 317 stainless steel breakaway bolts shall be used to join the break-away spool section to the hydrant top section.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examination: Examine substrates, adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected

3.2 PREPARATION

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

3.3 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.4 PIPING INSTALLATION

A. Project site water lines shall terminate approximately five feet from buildings, unless otherwise indicated on Drawings. Install temporary cap or plug terminals for future connection to building.

B. Bury piping with depth of cover over top at least 36 inches, unless otherwise indicated.

C. Comply with NFPA 24 for fire-service-main piping materials and installation.

D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports for all lines NPS 3 or greater.

H. Water Main Connection: Arrange and pay for tap in the water main, water meter, and all associated fees from the water purveyor.

3.5 CLEARANCE OF WATER LINE

A. Building or Structure: Two feet minimum horizontal separation.

B. Sewer crossing:

1. Typical Conditions: Lay water mains over sanitary sewers to provide vertical separation minimum three feet.
2. Unusual Conditions: If above separation cannot be met, for sewers less than three feet below the water pipe, use the following:

    a. Install water line with all joints located at least four feet from each side of the sewer pipe.
    b. Sewer pipe encased in six inches concrete around pipe, and extend four feet either side of water main.

C. Parallel to Sewer Line: Water line shall not be installed in a common trench with the building sanitary sewer unless both of the following requirements are met:

1. The bottom of the water pipe, at all points, shall be at least 12 inches above the top of the sewer.
2. The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a minimum clear horizontal distance of at least 12 inches from the sewer.

3.6 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches for all lines NPS 3 or greater. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.
4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Vertical-Type Indicator Post Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

3.8 FIRE HYDRANT INSTALLATION

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

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

3.9 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. Refer to Division 31 Section "Earth Moving" for tape specifications.

3.10 FIELD QUALITY CONTROL

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

B. Hydrostatic Tests:

1. Domestic Water: The piping shall be subjected for a minimum of two hours to a pressure of one and one-half times the working pressure, but in no case less than 150 psi. Examine all exposed pipe, joints, fittings and accessories during the test period. Replace or repair defective portions of the system, and repeat tests until results are satisfactory.

2. Fire Water: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure at ±5 psi for 2 hours. Examine all exposed pipe, joints, fittings and accessories during the test period. Replace or repair defective portions of the system, and repeat tests until results are satisfactory.

3. Allowable leakage shall be as specified in AWWA C-600, Table 3.

C. Prepare reports of testing activities.

3.11 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours, or
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for three hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331100

SECTION 333100 – SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

A. Manufacturer’s product data for pipe and fittings.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification: Medium and Heavy duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: Two percent through manhole unless otherwise noted.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: Four percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
5. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.3 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops three inches above finished surface elsewhere, unless otherwise indicated.

3.4 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

3.5 FIELD QUALITY CONTROL

A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.
    f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

B. Leaks and loss in test pressure constitute defects that must be repaired.

C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 333100

SECTION 334100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage pipe and drainage structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

A. Product Data: For each type of product installed.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) HDPE PIPE AND FITTINGS

A. HDPE Drainage Pipe and Fittings, NPS 4 to NPS 10: AASHTO M252, Type S, with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seals.

B. HDPE Drainage Pipe and Fittings, NPS 12 to NPS 60: AASHTO M294, Type S, or ASTM F2306 with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seal.

2.4 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.6 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.
5. Ballast and Pipe Supports: Portland cement design mix, 3,000 pounds per square inch (psi) minimum, with 0.58 maximum water-cementitious materials ratio.

a. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
b. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.8 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (heavy traffic) structural loading unless otherwise indicated. Include 24-inch ID by seven- to nine-inch riser with four-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.
b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.2 PIPING INSTALLATION

A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

B. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections unless direct tap into existing storm drain is indicated.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

E. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

3.6 FIELD QUALITY CONTROL

A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.
5. Hydrostatic Tests: Test sewers according to requirements of authorities having jurisdiction and the following:

    a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).
7. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

B. Leaks and loss in test pressure constitute defects that must be repaired.

C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334100

SECTION 334600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes subdrainage systems for rubberized material.

1.2 SUBMITTALS

A. Product Data: For perforated pipe, fitting, and drainage panel.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated plastic pipe shall be either smooth-wall polyvinyl chloride plastic pipe, corrugated polyvinyl chloride plastic pipe with a smooth interior surface, or corrugated polyethylene plastic tubing.

1. Smooth-wall polyvinyl chloride plastic pipe shall conform to the requirements in AASHTO Designation: M 278.

2.2 PERFORATIONS

A. Perforations per ASTM F 758, section 7.2.4. and Table 5.

1. NPS 4: 2 rows of perforations.

2.3 FITTINGS

A. Polyvinyl chloride pipe shall be connected with belled ends, or with sleeve-type or stop-type couplings conforming to the requirements in AASHTO Designation: M 278. Polyethylene tubing shall be connected with snap-on, screw-on, or wrap-around fittings and couplings conforming to the requirements of AASHTO Designation: M 252 or M 294. Solvent cementing of joints will not be required.

2.4 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

1. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.
2. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

B. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 2 Section "Earthwork."

2.5 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Underground Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Header Piping:

1. PE drainage tubing and fittings, couplings, and coupled joints.
2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.

3. Lay perforated pipe with perforations down.
4. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

D. Install PVC piping according to ASTM D 2321.

3.4 PIPE JOINT CONSTRUCTION

A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."

B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.

C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties..

3.6 FIELD QUALITY CONTROL.

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.7 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600