

PROJECT MANUAL

BIG BEAR ADMINISTRATIVE FACILITY

Mountain Area Regional Transit Authority

BIG BEAR LAKE, CA

CONSTRUCTION DOCUMENTS

ADMINISTRATION BUILDING, & SITE WORK

Divisions 00 - 33

5.08.03

October 2025



**SECTION 00 01 01  
PROJECT TITLE PAGE**

**PROJECT MANUAL  
FOR  
BIG BEAR ADMINISTRATIVE FACILITY**

**MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY**

**PO BOX 1501 BIG BEAR LAKE, CA 92315**

**909.878.5200**

**MOUNTAINTRANSIT.ORG**

**PROJECT LOCATION**

**41968 FOX FARM ROAD**

**BIG BEAR LAKE, CALIFORNIA 92315**

**PREPARED BY:**

**ARCHITECT**

**RUHNAU CLARKE ARCHITECTS**

3775 Tenth Street, Riverside CA 92501 - 5751 Palmer Way, Suite C, Carlsbad, CA 92010

951.684.4664 - 760.438.5899

[www.ruhnaucclarke.com](http://www.ruhnaucclarke.com)

NOTICE: This Project Manual, is an unpublished instrument of service of the authors. It is prepared for use only on this Project and in conjunction with the authors' interpretations, observations, decisions and administration, as described in the Conditions of the Contract. Desired results without these services cannot be assured. Use in whole or in part, without the authors' services and expressed written consent may violate Act 17 U.S.C. par. 301 (1991).

**END OF PROJECT TITLE PAGE**



**SECTION 00 01 02**  
**PROJECT INFORMATION**

**PART 1 GENERAL**

**1.01 PROJECT IDENTIFICATION**

- A. Project Name: Big Bear Administrative Facility, located at:

Project Number: 5-08-03.

41968 Fox Farm Road.

Big Bear Lake, California 92315.

- B. The Owner, hereinafter referred to as Owner:

**Mountain Area Regional Transit Authority**

PO Box 1501 Big Bear Lake, CA 92315

mountaintransit.org

909.878.5200

**1.02 NOTICE TO PROSPECTIVE BIDDERS**

- A. These documents constitute an Invitation to Bid to and request for qualifications from General Contractors for the construction of the project described below.

**1.03 PROJECT DESCRIPTION**

- A. Summary Project Description: A new one story office building and related site work.  
B. Contract Scope: Grading and underground utilities and Construction.  
C. Contract Terms: Lump sum (fixed price, stipulated sum).

**1.04 PROJECT CONSULTANTS**

- A. The Architect, hereinafter referred to as Architect: **Ruhnau Clarke Architects**

3775 Tenth Street, Riverside CA 92501 - 5751 Palmer Way, Suite C, Carlsbad, CA 92010

www.ruhnauclarke.com

951.684.4664 - 760.438.5899

**1.05 PROCUREMENT TIMETABLE**

- A. Last Request for Substitution Due: 14 days prior to due date of bids.  
B. Last Request for Information Due: 14 days prior to due date of bids.  
C. Contract Time: To be stated in bid documents.  
D. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

**1.06 PROCUREMENT DOCUMENTS**

- A. Availability of Documents: Complete sets of procurement documents may be obtained:

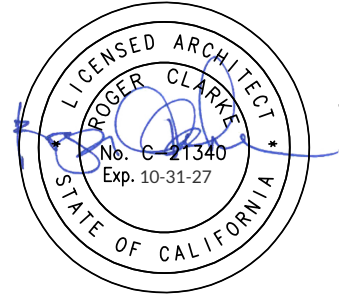
1. From Owner at the Project Manager's address listed above.

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**END OF SECTION**

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**SECTION 00 31 00**  
**AVAILABLE PROJECT INFORMATION**

**PART 1 GENERAL**

**1.01 EXISTING CONDITIONS**

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:
- B. Geotechnical Report:
  - 1. Original copy is available for inspection at Owner's offices during normal business hours.
  - 2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
    - a. Soil and subsurface investigations conducted at site by an independent testing laboratory and report with log of borings prepared.
  - 3. Interpretation:
    - a. The Owner, Architect and Engineers disclaim all responsibility for the accuracy of information prepared by others.
      - 1) The Owner, Architect and Engineers disclaim all responsibility for the information to be completely representative of conditions and materials which may be encountered and as being adequate for the purposes of construction.
      - 2) Variations in kind, depth, quantity, and condition of soils may occur.
      - 3) The Owner, Architect and Engineers further disclaim responsibility for interpretation by Bidding Contractors and others of soil and subsurface investigation information, such as in projecting soil-bearing values, rock profiles, presence and scope of boulders and cobbles, soil stability and the presence, level and extent of underground water.
    - b. Soils investigation report and data are not part of Contract Documents.
  - 4. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
  - 5. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner.
    - a. If variances from Geotechnical Report are found, make written report to Owner Representative.
    - b. Claims for conditions found to be not as indicated in soil investigation data not permitted, unless otherwise indicated in Owner-Contractor Agreement.
      - 1) This applies only to conditions found after execution of the Agreement to be materially different from those reported and which are not customarily encountered in the geographic area.

## **1.02 BIDDER'S INVESTIGATIONS**

- A. Bidder's Investigation: Bidder shall visit site and become familiar with site conditions.
  - 1. Bidder may, at Bidder's own expense and prior to bidding, make soil surveys and investigations Bidder considers necessary.
  - 2. Bidder assumes risk that soil and underground conditions may be other than that indicated in soil investigation data.
- B. Procedures:
  - 1. Obtain authorization from Owner Representative prior to start of borings or subsurface investigations.
  - 2. Immediately upon completion of Bidder's subsurface investigation, return site areas affected by investigations to condition existing prior to start of Bidder subsurface investigations as directed by Owner Representative.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

## **SECTION 01 10 00 SUMMARY**

### **PART 1 GENERAL**

#### **1.01 PROJECT**

- A. Project Name: Big Bear Administrative Facility
- B. Owner's Name: Mountain Area Regional Transit Authority.
- C. Architect's Name: Ruhnau Clarke Architects.
- D. The Project consists of the construction of a new bus service facility administration office building located at 41968 Fox Farm Road.

#### **1.02 CONTRACT DESCRIPTION**

- A. Contract Type: Multiple prime contracts each based on a Stipulated Price as described in Owner-Contractor Agreement.
- B. The work of each separate prime contract is identified in this section and on Drawings.
- C. The Work: The Work is construction and related services for a , CBC, Occupancy Type Business Group B, Construction Type V-B, , totaling approximately 14,392 square feet.
  - 1. The Work includes new building construction, interior improvements, building utilities, and related site improvements; with patch and repair as required, and other features to the extent indicated on the Drawings.

#### **1.03 CONTRACT DOCUMENTS**

- A. Contract Requirements:
  - 1. Conditions of the Contract and other Contract documents have been included in the Project Manual, as indicated in the Table of Contents.
    - a. Such documents are not Specifications.
  - 2. Specifications are found in Divisions 01 through 33 of the Project Manual.
- B. Contract Drawings: The Drawings provided with and identified in the Project Manual are the Drawings referenced in the Agreement.
  - 1. The location, extent and configuration of the required construction and improvements are shown and noted on Drawings.
    - a. The Drawings are referenced in the Agreement.
    - b. An index of Drawings is included in the set of Drawings.
  - 2. Drawings are arranged into series according to design discipline. Such organization and all references to trades, subcontractor, specialty contractor or supplier shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of the Work to be performed by any trade.

3. Where the terms "as shown", "as indicated", "as noted", "as detailed", "as scheduled", or terms of like meaning, are used in the Drawings or Specifications, it shall be understood that reference is being made to the Drawings referenced in the Agreement.
  4. Where reference to the word "plans" is made anywhere in Drawings, Specifications and related Contract Documents, it shall be understood to mean the Drawings referenced in the Agreement.
- C. Contract Specifications: The Specifications provided in the Project Manual are the Specifications referenced in the Agreement.
1. Specifications are organized by Divisions and Sections in accordance with the recommended practices of the Construction Specifications Institute.
    - a. Such organization shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of Work to be performed by any trade.
  2. Specifications are included in the Project Manual, which may also include other Bidding and Contract Documents.
    - a. Contents of the Project Manual are listed in Document 00 01 10 - Table of Contents, in the Project Manual.

#### **1.04 WORK BY OWNER**

- A. Concurrent Work Under Separate Contracts:
1. Work Under Separate Contracts: Owner will award separate contracts for products and installation for interior improvements and other work as may be indicated on Drawings as NIC (Not in Contract).
  2. Relationship to Work Under the Contract:
    - a. Work under the Contract shall include all provisions necessary to make such concurrent work under separate contracts complete in every respect and fully functional, including field finishing.
    - b. Provide necessary backing, supports, piping, conduit, conductors and other such provisions from point of service to point of connection, as shown on Drawings and specified herein.
  3. Related Contract Documents:
    - a. Owner will make available, in a timely manner, drawings and specifications of work under separate contracts for coordination and further description of that work.
    - b. Such drawings and other data required for the coordination of the work of separate contracts with the Work of this Contract may be included with the Contract Documents.
    - c. If so, they are provided for convenience only and are not to be considered Contract Documents produced by Architect or Architect's consultants.
  4. Permits, Notices and Fees:
    - a. Permits, Notices and Fees: Notices required by and approvals required of authorities having jurisdiction for work under separate contracts and related fees will be solely the responsibility of Owner.

- B. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
  - 1. Movable cabinets.
  - 2. Furnishings.
  - 3. Small equipment.
  - 4. Rugs.
  - 5. Artwork.
- C. Owner will supply the following for installation by Contractor:
  - 1. Owner-Furnished Products: Owner may furnish, for installation by Contractor, products which are identified on the Drawings and in the Specifications as OFCI (Owner-Furnished/Contractor-Installed).
  - 2. Relationship to Work Under the Contract:
    - a. Work under the Contract shall include all provisions necessary to fully incorporate such products into the Work, including, as necessary.
      - 1) Fasteners.
      - 2) Backing,.
      - 3) Supports.
      - 4) Piping.
      - 5) Conduit.
      - 6) Conductors.
      - 7) Other such provisions from point of service to point of connection.
      - 8) Field finishing, as shown on Drawings and specified herein.
    - b. See Section 01 30 00 - Administrative Requirements for additional requirements.

#### **1.05 PERMITS, LICENSES AND FEES**

- A. Permits:
  - 1. For Work included in the Contract, Contractor shall obtain all permits from authorities having jurisdiction and from serving utility companies and agencies.
  - 2. Owner will reimburse Contractor for amount charged for such permits, without mark-up.
  - 3. For Work performed under design/build basis, plan check and permit fees shall be included in the Contract Sum.
- B. Licenses:
  - 1. Contractor shall obtain and pay all licenses associated with construction activities, such as business licenses, contractors' licenses and vehicle and equipment licenses.
  - 2. All costs for licenses shall be included in the Contract Sum.
- C. Assessments:
  - 1. Owner will pay all assessments and utility service connection fees. Costs of assessments shall not be included in the Contract Sum.
- D. Test and Inspection Fees:

1. Contractor shall pay all fees charged by authorities having jurisdiction and from serving utility companies and agencies, for tests and inspections conducted by those authorities, companies and agencies.
2. Owner will reimburse Contractor for actual amount of such fees, without mark-up.
3. Refer to Section 01 40 00 - Quality Requirements for additional information on tests and inspections and responsibility for payment of fees.

#### **1.06 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing site during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

#### **1.07 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
  1. Owner occupancy.
  2. Work by Others.
  3. Work by Owner.
  4. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by Owner:
  1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  2. Site Access:
    - a. Limit access to site to indicated routes and access points as indicated.
    - b. If routes and access points are not indicated, access shall be as approved by Owner.
    - c. Do not restrict access to adjacent properties and do not restrict access for those performing work under separate contracts for the Owner.
  3. Do not obstruct roadways, sidewalks, or other public ways without permit.
  4. Construction Limit:
    - a. Limit construction activities to areas indicated on Drawings as Project Area or, if not indicated, to areas within the parcel as described in the legal description on the Drawings.
    - b. Refer also to Section 01 50 00 - Temporary Construction Facilities and Controls for additional requirements.
- D. Existing building spaces may not be used for storage.
- E. Time Restrictions:

1. Limit conduct of especially noisy malodorous and dusty exterior work to the hours of 8 AM to 6 PM.
  2. Limit conduct of especially noisy interior work to the hours of 9 AM to 4 PM.
- F. Utility Outages and Shutdown:
1. Limit disruption of utility services to hours the site is unoccupied.
  2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
  3. Prevent accidental disruption of utility services to other facilities.

#### **1.08 CONSTRUCTION WASTE MANAGEMENT**

- A. Construction and waste management, complying with Section 01 74 19 - Construction Waste Management and Disposal, is a requirement for this project.
- B. The Contractor, Prime Contractors, and subcontractors all have obligations in meeting the requirements of this specification.

**END OF SECTION**

**SECTION 01 20 00  
PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 78 00 - Closeout Submittals: Project record documents.

**1.03 SCHEDULE OF VALUES**

- A. Use Schedule of Values Form:
  - 1. Form provided by Owner.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- F. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- H. Revise schedule to list approved Change Orders, with each Application For Payment.
  - 1. List each authorized Change Order as an extension on the continuation sheet, listing the Change Order number and dollar value as for an original portion of Work.

**1.04 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
  - 1. Substantiating information will normally be required only for those portions of Work whose completion state cannot be readily determined by observation of the completed Work.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.



- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
  - 1. Item Number.
  - 2. Description of work.
  - 3. Scheduled Values.
  - 4. Previous Applications.
  - 5. Work in Place and Stored Materials under this Application.
  - 6. Authorized Change Orders.
  - 7. Total Completed and Stored to Date of Application.
  - 8. Balance to Finish.
  - 9. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
  - 1. No Change Orders shall be included with Application for Payment until approved in writing by Owner and Architect. Also approved by DSA when appropriate.
- I. Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
  - 1. Transmittal letter as specified for submittals in Section 01 30 00.
  - 2. Construction progress schedule, revised and current as specified in Section 01 32 16.
  - 3. Current construction photographs specified in Section 01 30 00.
  - 4. Partial release of liens from major subcontractors and vendors.
    - a. Provide with each Application for Payment lien releases from all subcontractors, workers and materials suppliers employed for the Project covering their portion of Work to date for which payment application is made. Lien release forms will be provided by Owner and shall be completed in accordance with directions provided.
  - 5. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
  - 6. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

#### **1.05 ADDENDA**

- A. Addenda are changes issued prior to the signing of the Contract for Construction. These Addenda shall be signed by the Architect and approved by the (Project City).

- B. These documents may or may not have approved by the (Project City) prior to the close of Bid.
  - 1. If not approved by AHJ prior to close of the bidding period, the contract price shall include the Addenda.
  - 2. No work shall proceed regarding any Addendum until approved by AHJ.
  - 3. Revisions to Addenda, when approved by AHJ, shall be incorporated by an additional addendum or Change Order as indicated below and as provided for in the Contract for Construction and General Conditions.

#### **1.06 MODIFICATION PROCEDURES**

- A. Construction Changes, General:
  - 1. The following describe administrative procedures to be followed in compliance with provisions of the Conditions of the Contract for Architect's Supplemental Instructions, Construction Change Directives, Construction Change Documents, and Contract Change Orders.
  - 2. The Architect will prepare and issue: Architect's Supplemental Instructions, a Construction Change Directive or a Request for Proposal to be presented to the Contractor for action.
- B. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- C. Contract Change Order Forms: Form as directed by Owner.
- D. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
  - 1. Architect's Supplemental Instructions:
    - a. Minor changes in the Work, not involving an adjustment in either the Contract Sum or Contract Time, as authorized by the Conditions of the Contract, will be presented by the Architect using the Architect's Bulletin form.
    - b. Should the Architect's Supplemental Instructions result in disputed costs and time adjustments, such dispute shall be resolved in accordance with the provisions of the Conditions of the Contract.
- E. AHJ Construction Change Document approval for substitutions and changes to structural, accessibility, or fire-life-safety portions of approved Drawings and Specifications is required from AHJ prior to fabrication and installation. DSA IR A-6; CAC Section 4-215, & 4-233(c).
  - 1. The approved Construction Change Document shall be signed by:
    - a. Architect of Record.
    - b. When applicable:
      - 1) Structural Engineer of Record.
      - 2) Mechanical Engineer of Record.
      - 3) Electrical Engineer of Record.
      - 4) Civil Engineer of Record.
      - 5) Delegated Professional Engineer.

- c. City Building Department for final approval.
- F. For other required changes, not involving structural, accessibility, or fire-life-safety portions of approved Drawings and Specifications, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
  - 3. Construction Change Directives: In accordance with provisions of the Conditions of the Contract, the Owner may direct the Contractor to proceed with a change in the Work prior to formal preparation, review and agreement of a Contract Change Order, in order to not delay construction.
    - a. The Architect will prepare and issue a change document containing a Construction Change Directive which, when signed by the Owner and the Architect, shall instruct the Contractor to proceed with a change in the Work, for subsequent inclusion in a Contract Change Order.
    - b. Should the Construction Change Directive result in disputed costs and time adjustments, such dispute shall be resolved in accordance with the provisions of the Conditions of the Contract.
    - c. Construction Change Directives shall follow procedures specified below for Contract Change Orders except that Contractor shall immediately proceed with the change upon receipt of the signed Change Directive.
- G. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.
  - 1. Such Request for Proposal may include an estimate of additions or deductions in Contract Time and Contract Sum for executing the change and may include stipulations regarding overtime work and the period of time the requested response from the Contractor shall be considered valid.
- H. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.
  - 1. After review of the request and with the Owner's approval, the Architect will prepare a change document containing a Request for Proposal, as described above.
  - 2. Issuance of such a request by the Architect shall not indicate authorization of the Contractor to proceed with the proposed change.
  - 3. Changes will be approved only by an approved Construction Change Directive and Contract Change Order.

- I. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
  - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
  - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
  - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
  - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- J. Substantiation of Costs: Provide full information required for evaluation.
  - 1. On request, provide the following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
  - 2. Support each claim for additional costs with additional information:
    - a. Origin and date of claim.
    - b. Dates and times work was performed, and by whom.
    - c. Time records and wage rates paid.
    - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
  - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
    - a. Cost and Time Resolution: If amounts for changes in Contract Sum and Contract Time cannot be agreed upon by Owner and Contractor, amounts shall be resolved in accordance with provisions of the Conditions of the Contract for resolution of disputes and the following:
      - 1) Contractor shall keep accurate records of time, both labor and calendar days, and cost of materials and equipment.
      - 2) Contractor shall prepare and submit an itemized account and supporting data after completion of changed Work, within the time limits indicated in the Conditions of the Contract.
      - 3) Contractor shall provide full information as required and requested, for Owner and Architect to evaluate and substantiate proposed costs and time for the change in the Work.
      - 4) When Owner and Contractor determine mutually acceptable amounts for changes in Contract Sum and Contract Time, a Contract Change Order shall be executed for these amounts.

- 5) Owner shall have the right to audit Contractor's invoices and bid quotations to substantiate costs for Contract Change Orders.
- K. Construction Changes Based on Stipulated Sum or Time: Based on the Contractor's response to a Request for Proposal or Construction Change Directive, the Owner and Architect will review the response.
    1. The Owner and Contractor shall negotiate a mutually acceptable adjustment in Contract Sum and Contract Time, as appropriate, prior to performance of the changed Work.
    2. A Contract Change Order for the stipulated amounts shall be prepared based on the stipulated sum and change in time.
  - L. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
    1. When agreement is reached on changes, if any, in the Contract Time and the Contract Sum, the Contractor shall prepare a Contract Change Order using a form as directed by the Owner, with supplementary documents as necessary to describe the change and the associated costs and schedule impacts.
    2. Construction Change Document approval is required from AHJ prior to fabrication and installation.
    3. Submit Contract Change Orders to Owner through the Architect.
    4. Contractor shall prepare and submit five original sets of documents for each Change Order. Owner, Architect and AHJ shall sign the Change Order indicating acceptance and approval of the change.
      - a. Structural Engineer shall also sign the Change Order, when applicable.
    5. All Change Orders must be approved by AHJ prior to fabrication and installation.
    6. Upon approval of the Change Order, Contractor shall promptly execute the change in the Work.
  - M. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
  - N. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
    1. Contractor shall submit revised schedules at the next Application for Payment following approval and acceptance of the Contract Change Order.
  - O. Promptly enter changes in Project Record Documents.

#### **1.07 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  1. All closeout procedures specified in Section 01 70 00.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 01 25 00 SUBSTITUTION PROCEDURES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 00 - Procurement and Contracting Requirements: Restrictions on timing of substitution requests.
- B. Section 00 43 25 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).
- C. Section 00 63 25 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).
- D. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.
- E. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- F. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

#### **1.03 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
  - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
    - a. Unavailability.
    - b. Regulatory changes.
  - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
    - a. Substitution requests offering advantages solely to the Contractor will not be considered.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 GENERAL REQUIREMENTS**

- A. Requests by Contractor to deviate from specified requirements for products, materials, equipment, and methods, or to provide products other than those specified, shall be considered requests for substitutions except under the following conditions:

1. Substitutions are requested during the bidding period, and accepted prior to execution of the Contract. Acceptance shall be in the form of written Addendum to the Bidding documents or revision to the Drawings or Specifications for use as Construction Contract Documents.
  2. Changes in products, materials, equipment, and methods of construction are directed by the Owner or Architect.
  3. Contractor options for provision of products and construction methods are specifically stated in the Contract Documents.
  4. Change in products, materials, equipment, and methods of construction is required for compliance with Codes, ordinances, regulations, orders and standards of authorities having jurisdiction.
- B. Substitution Provisions: Refer to substitution provisions of the Conditions of the Contract, in addition to the requirements specified herein. Provisions for consideration and acceptance of substitutions shall be as follows:
1. Documentation:
    - a. Substitutions will not be considered if they are indicated or implied on shop drawing, product data or sample submittals.
    - b. All requests for substitution shall be made by separate written request from Contractor.
  2. Cost and Time Considerations: Substitutions will not be considered unless a net reduction in Contract Sum or Contract Time results to the Owner's benefit, including redesign costs, life cycle costs, changes in related Work and overall performance of building systems.
  3. Design Revision:
    - a. Substitutions will not be considered if acceptance will require substantial revision of the Contract Documents or will substantially change the intent of the design, in the opinion of the Architect.
    - b. The intent of the design shall include functional performance and aesthetic qualities.
  4. Data: It shall be the responsibility of the Contractor to provide adequate data demonstrating the merits of the proposed substitution, including cost data and information regarding changes in related Work.
  5. Determination by Architect:
    - a. Architect will determine the acceptability of proposed substitutions and will notify Contractor, in writing within a reasonable time, of acceptance or rejection.
    - b. The determination by the Architect regarding functional performance and aesthetic quality shall be final.
  6. Non-Acceptance: If a proposed substitution is not accepted, provide the specified product.
    - a. If, in the opinion of the Architect, the substitution request is incomplete or has insufficient data to enable a full and thorough review of the intended substitution, the substitution may be summarily refused and determined to be unacceptable.



7. Substitution Limitation: Only one request for substitution will be considered for each product.
- C. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
    - a. Include a signed certification that the Contractor has:
      - 1) Reviewed the proposed substitution and has determined that the substitution is equivalent or superior in every respect to product requirements indicated or product specified in the Contract Documents.
      - 2) Certify the proposed substitution is suited for and can perform the purpose or application of the specified product indicated or specified in the Contract Documents.
  2. Agrees to provide the same warranty for the substitution as for the specified product.
  3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
  4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  5. Waives claims for additional costs or time extension that may subsequently become apparent.
    - a. Include a signed waiver by the Contractor for changes in the Contract Time or Contract Sum because of the following:
      - 1) Substitution failed to perform adequately.
      - 2) Substitution required changes in on other elements of the Work.
      - 3) Substitution caused problems in interfacing with other elements of the Work.
      - 4) Substitution was determined to be unacceptable by authorities having jurisdiction.
  6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- D. A Substitution Request for specified installer constitutes a representation that the submitter:
1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
1. Note explicitly any non-compliant characteristics.
- F. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Forms indicated and included in the Project Manual are adequate for this purpose, and must be used.
  2. No specific form is required. Contractor's Substitution Request documentation must include the following:

- a. Project Information:
  - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
  - 2) Owner's, Architect's, and Contractor's names.
- b. Substitution Request Information:
  - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
  - 2) Indication of whether the substitution is for cause or convenience.
  - 3) Issue date.
  - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
  - 5) Description of Substitution.
  - 6) Reason why the specified item cannot be provided.
  - 7) Differences between proposed substitution and specified item.
  - 8) Description of how proposed substitution affects other parts of work.
- c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
  - 1) Physical characteristics.
  - 2) In-service performance.
  - 3) Expected durability.
  - 4) Visual effect.
  - 5) Sustainable design features.
  - 6) Warranties.
  - 7) Other salient features and requirements.
  - 8) Include, as appropriate or requested, the following types of documentation:
    - (a) Product Data:
    - (b) Samples.
    - (c) Certificates, test, reports or similar qualification data.
    - (d) Drawings, when required to show impact on adjacent construction elements.
  - 9) Include a detailed description, in written or graphic form as appropriate, indicating all changes or modifications needed to other elements of the Work and to construction to be performed by the Owner and by others under separate Contract with Owner, that will be necessary if the proposed substitution is accepted.
- d. Impact of Substitution:
  - 1) Savings to Owner for accepting substitution.
    - (a) Include detailed cost data, including a proposal for the net change, if any, in the Contract Sum.

- 2) Change to Contract Time due to accepting substitution.
  - (a) Indicate the substitution's effect on the Construction Schedule. Indicate the effect of the proposed substitution on overall Contract Time and, as applicable, on completion of portions of the Work for use by Owner or for work under separate contract by Owner.
- G. Limit each request to a single proposed substitution item.
  1. Submit an electronic document, combining the request form with supporting data into single document.

### **3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
- B. Pursuant to Section 3400 of the Public Contract Code, requests for substitution will be considered only if received up to 7 days prior to the bid date. Subsequent requests will be considered only in the case of product unavailability, through no fault of the Contractor , or for reasons of cost reducing value analysis requested by the Owner .
- C. Submittal Form (before award of contract):
  1. Submit substitution requests by completing the form in Section 00 43 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

### **3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submittal Form (after award of contract):
  1. Submit substitution requests by completing the form in Section 00 63 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. After Contract award, requests will be considered for cause only; in the case of product unavailability, through no fault of the Contractor , or for reasons of cost reducing value analysis requested by the Owner.
  1. Substitutions will be considered when a product, through no fault of the Contractor, becomes unavailable or unsuitable due to regulatory change.
  2. Product Availability Waiver:
    - a. Substitutions will be considered after 35 day time limit only when a product becomes unavailable due to no fault of Contractor.
    - b. Failure to place orders for specified products sufficiently in advance of required date for incorporation into the Work will not be considered as a valid reason for which Contractor may request a substitution or deviation from requirements of the Drawings and Specifications.
  3. Waiver: At the discretion of the Owner, limitations on substitutions may be waived.
- C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
  - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
  - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
  - 3. Bear the costs engendered by proposed substitution of:
    - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
    - b. Other construction by Owner.
    - c. Other unanticipated project considerations.
- E. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.
  - 3. When acceptance will require revisions to Contract Documents.

#### **3.04 CONTRACT DOCUMENT REVISIONS:**

- A. Should a Contractor-proposed substitution or alternative sequence or method of construction require revision of the Contract Drawings or Specifications;
  - 1. Including revisions for the purposes of determining feasibility, scope or cost, or revisions for the purpose of obtaining review and approval by authorities having jurisdiction.
  - 2. Revisions will be made by Architect or other consultant of Owner who is the responsible design professional, as approved in advance by Owner.
- B. Services of Architect or other consultant of the Owner, including time spent in researching and reporting on proposed substitutions or alternative sequence and method of construction, shall be paid by Contractor when such activities are considered additional services to the design services contracts of the Architect or other responsible design professional with the Owner.
- C. Costs of services by Architect or other responsible design professional of the Owner shall be paid on a time and materials basis, based on current hourly fee schedules, with reproduction, long distance telephone and shipping costs reimbursable at cost plus usual and customary mark-up for handling and billing.
- D. Such fees shall be paid whether or not the proposed substitution or alternative sequence or method of construction is ultimately accepted by Owner and a Change Order is executed.
- E. Such fees shall be paid from Contractor's portion of savings, if a net reduction in Contract Sum results. If fees exceed Contractor's portion of net reduction, Contractor shall pay all remaining fees unless otherwise agreed in advance by the Owner.

- F. Such fees owed shall be deducted from the amount owed Contractor on the Application for Payment next made following completion of revised Contract Drawings and Specifications or completion of research and other services. Owner will then pay Architect or other consultant of the Owner.
- G. Certain substitutions require approval from AHJ.

### **3.05 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
  - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

### **3.06 ACCEPTANCE**

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

### **3.07 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

### **3.08 ATTACHMENTS**

- A. A facsimile of the Substitution Request Form (During Construction) required to be used on the Project is included after this section.

## **END OF SECTION**

## **SECTION 01 30 00 ADMINISTRATIVE REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Coordination drawings.
- J. Submittals for review, information, and project closeout.
- K. Number of copies of submittals.
- L. Requests for Interpretation or Information (RFI) procedures.
- M. Submittal procedures.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 32 16 - Construction Progress Schedule: Form, content, and administration of schedules.
- B. Section 01 60 00 - Product Requirements: General product requirements.
- C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.
- E. Section 01 91 13 - General Commissioning Requirements: Additional procedures for submittals relating to commissioning.
  - 1. Where submittals are indicated for review by both Architect and the Commissioning Authority, submit one extra and route to Architect first, for forwarding to the Commissioning Authority.
  - 2. Where submittals are not indicated to be reviewed by Architect, submit directly to the Commissioning Authority; otherwise, the procedures specified in this section apply to commissioning submittals.
- F. Technical Product Sections: Procedures for specific submittals specified in those Sections to be made at Contract closeout.

### **1.03 DEFINITIONS**

- A. Action Submittals: Written and graphic information that requires responsive action by Owner Representative and Architect or other responsible design professional.
- B. Informational Submittals: Written information that does not require responsive action by Owner Representative and Architect or other responsible design professional.
- C. Unsolicited Submittals: Action or informational submittals not required by the Contract Documents or not requested by the reviewer. Unsolicited submittals may be returned with notation "not reviewed."
- D. Product Data: Standard published information ("catalog cuts") and specially prepared data for the Work of the Contract, including standard illustrations, schedules, brochures, diagrams, performance charts, instructions and other information to illustrate a portion of the Work.
- E. Request for Interpretation or Information (RFI): A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.
- F. Samples: Physical examples that demonstrate the materials, finishes, features, workmanship and other characteristics of a portion of the Work. Accepted samples shall serve as quality basis for evaluating the Work.
- G. Shop Drawings, Product Data and Samples: Instruments prepared and submitted by Contractor, for Contractor's benefit, to communicate to Architect the Contractor's understanding of the design intent, for review and comment by Architect on the conformance of the submitted information to the general intent of the design. Shop drawings, product data and samples are not Contract Documents.
- H. Shop Drawings: Drawings, diagrams, schedules and illustrations, with related notes, specially prepared for the Work of the Contract, to illustrate a portion of the Work.
- I. Other Submittals: Technical data, test reports, calculations, surveys, certifications, special warranties and guarantees, operation and maintenance data, extra stock and other submitted information and products shall not be considered as Contract Documents but shall be information from Contractor to Architect to illustrate a portion of the Work for confirmation of understanding of design intent.

### **1.04 PROJECT COORDINATOR**

- A. Project Coordinator: Construction Manager.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for material delivery access, traffic, and parking facilities.
  - 1. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
  - 1. Requests for Interpretation or Information.
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Coordination drawings.
  - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 11. Closeout submittals.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
  - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation or Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
  - 2. Contractor and Architect are required to use this service.
  - 3. It is Contractor's responsibility to submit documents in allowable format.
  - 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
  - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, [www.adobe.com](http://www.adobe.com), or Bluebeam PDF Revu, [www.bluebeam.com](http://www.bluebeam.com)), unless such software capability is provided by the service provider.



6. Unless specifically requested, paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
  7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: The selected service is:
1. Bluebeam Software Inc.; Bluebeam Revu Studio: [www.bluebeam.com](http://www.bluebeam.com).
  2. Other Service acceptable to both Owner and Architect.
    - a. Direct email with PDF copies.
- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
1. Representatives of Owner are scheduled and included in this training.
- E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

### **3.02 PRECONSTRUCTION MEETING**

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
1. Owner.
  2. Architect.
  3. Contractor.
- C. Agenda:
1. Execution of Owner-Contractor Agreement.
  2. Submission of executed bonds and insurance certificates.
  3. Distribution of Contract Documents.
  4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
  5. Submission of initial Submittal schedule.
  6. Designation of personnel representing the parties to Contract and <1|A/E|>.
  7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  8. Scheduling.
  9. Scheduling activities of a Geotechnical Engineer.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.03 SITE MOBILIZATION MEETING**

- A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.
6. Inspector of Record.

C. Agenda:

1. Distribute and discuss list of subcontractors and suppliers.
2. Project Communication Procedures: Review requirements and administrative requirements for written and oral communications.
  - a. Review requirements and administrative procedures Contractor may wish to institute for identification and reporting purposes.
3. Change Procedures: Review requirements and administrative procedures for Change Orders, Construction Change Directives, Architect's supplemental instructions and Contractor's Requests for Interpretation or Information.
  - a. Site access restrictions, if any, and requirements to avoid disruption of operations at adjoining facilities or operations.
  - b. Construction Facilities and Temporary Utilities: Designate storage and staging areas, construction office areas; review temporary utility provisions; present Owner's requirements for use of premises.
4. Owner's requirements.
5. Construction facilities and controls provided by Owner.
6. Temporary utilities provided by Owner.
7. Survey and building layout.
8. Security and housekeeping procedures.
9. Schedules.
  - a. Distribute and discuss initial construction schedule and critical work sequencing of major elements of Work;
  - b. Include coordination of Owner Furnished / Contractor Installed (OFCl) products;
10. Application for payment procedures.
11. Procedures for testing.
12. Procedures for maintaining record documents.
13. Requirements for start-up of equipment.
14. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the work at maximum bi-weekly intervals.
- B. Meeting Time and Location: As mutually agreed by Owner, Architect, and Contractor, at on-site location.
- C. Special Meetings: As necessary, Owner Representative may convene special meetings to discuss specific construction issues in detail and to plan specific activities.
  - 1. See Section 01 70 00 - Execution and Closeout Requirements.
- D. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect.
  - 4. Contractor's superintendent.
  - 5. Major subcontractors.
- E. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems that impede, or will impede, planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of RFIs log and status of responses.
  - 7. Review of off-site fabrication and delivery schedules.
  - 8. Maintenance of progress schedule.
  - 9. Corrective measures to regain projected schedules.
    - a. Develop corrective measures and procedures, including but not necessarily limited to additional personnel loading to regain planned schedule.
  - 10. Planned progress during succeeding work period.
  - 11. Coordination of projected progress.
  - 12. Maintenance of quality and work standards.
  - 13. Effect of proposed changes on progress schedule and coordination.
  - 14. Other business relating to work.
- F. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### **3.05 CONSTRUCTION PROGRESS SCHEDULE**

- A. Contractor's Review: All schedules shall be reviewed and approved by Contractor prior to submission for Architect's and AHJ's review.

- B. Reviews by Architect and AHJ will be to ascertain the general status of construction and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.

### **3.06 DAILY CONSTRUCTION REPORTS**

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. In addition to transmitting electronically a copy to Owner and Architect, submit two printed copies at weekly intervals.
  - 1. Submit in format acceptable to Owner.
  - 2. Submit using required form, a sample of which is appended to this section.
- C. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
  - 1. Date.
  - 2. High and low temperatures, and general weather conditions.
  - 3. List of subcontractors at Project site.
  - 4. List of separate contractors at Project site.
  - 5. Approximate count of personnel at Project site.
    - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
  - 6. Major equipment at Project site.
  - 7. Material deliveries.
  - 8. Safety, environmental, or industrial relations incidents.
  - 9. Meetings and significant decisions.
  - 10. Unusual events (submit a separate special report).
  - 11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
  - 12. Meter readings and similar recordings.
  - 13. Emergency procedures.
  - 14. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
  - 15. Change Orders received and implemented.
  - 16. Testing and/or inspections performed.
  - 17. List of verbal instruction given by Owner and/or Architect.
  - 18. Signature of Contractor's authorized representative.

### **3.07 PROGRESS PHOTOGRAPHS**

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

- B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- C. Photography Type: Digital; electronic files.
- D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- E. In addition to periodic, recurring views, take photographs of each of the following events:
  - 1. Completion of site clearing.
  - 2. Excavations in progress.
  - 3. Foundations in progress and upon completion.
  - 4. Structural framing in progress and upon completion.
  - 5. Enclosure of building, upon completion.
  - 6. Final completion, minimum of ten (10) photos.
- F. Take photographs as evidence of existing project conditions as follows:
  - 1. Interior views: each elevation, floor and ceilings prior to demolition.
  - 2. Exterior views: each elevation, roof and areas adjacent to construction limits.
- G. Views:
  - 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
  - 2. Consult with Architect for instructions on views required.
  - 3. Provide factual presentation.
  - 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
  - 5. Point of View Sketch: Provide sketch identifying point of view of each photograph.
- H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
  - 1. Delivery Medium: Via email.
  - 2. File Naming: Include project identification, date and time of view, and view identification.
  - 3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
  - 4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
  - 5. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

### **3.08 COORDINATION DRAWINGS**

- A. See Section 01 31 14 - Facility Services Coordination.
- B. Provide information required by Project Coordinator for preparation of coordination drawings.
- C. Review drawings prior to submission to Architect.

### 3.09 REQUESTS FOR INTERPRETATION OR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
  - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in the Contract Documents.
  - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
  - 1. Prepare a separate RFI for each specific item.
    - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    - b. Do not forward requests which solely require internal coordination between subcontractors.
  - 2. Prepare in a format and with content acceptable to Owner.
  - 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
  - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
    - a. Submit RFIs from subcontractors and material suppliers through, be reviewed by and be attached to an RFI prepared, signed and submitted by Contractor.
      - 1) RFIs from subcontractors and material suppliers are to be:
        - (a) Reviewed by Contractor.
        - (b) Corrected and rewritten to clarify as required by Contractor.
        - (c) Placed on the proper form, then signed, and submitted by Contractor.
        - (d) RFIs submitted directly by subcontractors or material suppliers will be returned unanswered to the Contractor.
      - 2) RFIs submitted directly by subcontractors or material suppliers will be returned unanswered to the Contractor.
    - b. Review all subcontractor- and supplier-initiated RFIs and take actions to resolve issues of coordination, sequencing and layout of the Work.
      - 1) RFIs submitted to request clarification of issues related to means, methods, techniques and sequences of construction or for establishing trade jurisdictions and scopes of subcontracts will be returned without response.

- (a) Such issues are solely the Contractor's responsibility.
- 2) Contractor is responsible for delays resulting from the necessity to resubmit an RFI due to insufficient or incorrect information presented in the RFI.
- 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
  - a. Approval of submittals (use procedures specified elsewhere in this section).
  - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
  - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
  - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
- 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
  - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
  - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
  - 2. Owner's, Architect's, and Contractor's names.
  - 3. Discrete and consecutive RFI number, and descriptive subject/title.
  - 4. Issue date, and requested reply date.
  - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
  - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
    - a. Inability to determine from the Contract Documents the exact material, process, or system to be installed;
    - b. Or when the elements of construction are required to occupy the same space (interference);
    - c. Or when an item of Work is described differently at more than one place in the Contract Documents.

7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
  - a. In all cases, furnish all information required for the Architect to analyze and/or understand the circumstances causing the RFI and prepare a clarification or direction as to proceed for RFIs issued to request clarification of issues related to:
    - 1) Means, methods, techniques and sequences of construction, for example
    - 2) Pipe and duct routing, clearances;
    - 3) Specific locations of Work shown diagrammatically;
    - 4) Apparent interferences and similar items.
    - 5) If information included with this type RFI by the Contractor is insufficient, the RFI will be returned unanswered.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
  1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  2. Note dates of when each request is made, and when a response is received.
  3. Highlight items requiring priority or expedited response.
  4. Highlight items for which a timely response has not been received to date.
  5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
  1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
  1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
  2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
  3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.



4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

### **3.10 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
  1. Submit at the same time as the preliminary schedule.
    - a. Submit initial Submittals Schedule within 14 days of date of Notice of Award of construction.
    - b. After review and return by Architect, resubmit Submittals Schedule within 10 days and thereafter submit updated Submittals Schedules at each Construction Progress Meeting.
    - c. Submit one copy each to Owner and Architect.
  2. Coordinate with Contractor's construction schedule and schedule of values.
  3. Format schedule to allow tracking of status of submittals throughout duration of construction.
    - a. Prepare schedules in Gantt format using software at Contractor's option, providing clear indication of sequencing and scheduling of Work, for determination of "critical path" of construction progress.
      - 1) Submittals shall be connected to the related construction element by a graphically indicated critical path on the same page.
      - 2) Present schedules using opaque reproductions on substantial paper, with sheet size a multiple of 8-1/2 by 11 inches and large enough to clearly read characters.
  4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
  5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

### **3.11 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  1. Product data.
  2. Shop drawings.
  3. Samples for selection.
  4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.

- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

### **3.12 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

### **3.13 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
    - a. Include operation and maintenance data submittals in Submittals Schedule specified above.
    - b. Provide space for review action stamps and, if required by governing authorities having jurisdiction, license seal of design Professional, if applicable.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### **3.14 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format with renderable text; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Small Size Sheets, Not Larger Than 11 by 17 inch: Submit one copy; the Contractor shall make his own copies from original returned by the Architect after making his own file copy.
- C. Extra Copies at Project Closeout: See Section 01 78 00.
- D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.
3. Quantity:
  - a. Submit minimum of four (4) samples of each of color, texture and pattern.
  - b. Submit one item only of actual assembly or product.
  - c. Unless otherwise noted, full-size and complete samples will be returned and may be incorporated into field mock-ups and the Work.

### **3.15 SUBMITTAL PROCEDURES**

#### **A. General Requirements:**

1. Use a separate transmittal for each item.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
3. Transmit using approved form.
4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
  - a. For example:
    - 1) 09 21 16-1 - First submittal for Section 09 21 16 - Gypsum Board Assemblies.
    - 2) 09 21 16-2 - Second submittal for Section 09 21 16 - Gypsum Board Assemblies.
  - b. Use same number for resubmittals as original submittal, followed by a letter indicating sequential resubmittal. For example:
    - 1) 09 21 16-2A - Resubmission of second submittal for Section 09 21 16 - Gypsum Board Assemblies.
    - 2) 09 21 16-2B - Second resubmission of second submittal for Section 09 21 16 - Gypsum Board Assemblies.
6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
  - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
  - b. Field measurements have been determined and verified.
  - c. Conformance with requirements of Contract Drawings and Specifications is confirmed.
  - d. Catalog numbers and similar data are correct.
  - e. Work being performed by various subcontractors and trades is coordinated.

- f. Field construction criteria have been verified, including confirmation that information submitted has been coordinated with the work being performed by others for Owner and actual site conditions.
    - g. All deviations from requirements of Drawings and Specifications have been identified and noted.
  - 7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    - a. Send submittals in electronic format via email to Architect.
    - b. Upload submittals in electronic form to Electronic Document Submittal Service website.
  - 8. Schedule submittals to expedite the Project, and coordinate submission of related items.
    - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
    - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
  - 9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
    - a. Changes in the Work shall not be authorized by submittals review actions.
    - b. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
    - c. Changes shall only be authorized by separate written Contract Change Order or Construction Change Directive, in accordance with the Conditions of the Contract and Section 01 20 00 - Price and Payment Procedures.
  - 10. Provide space for Contractor and Architect review stamps.
  - 11. When revised for resubmission, identify all changes made since previous submission.
  - 12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
  - 13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
  - 14. Submittals not requested will be recognized, but will be returned without comment,
- B. Product Data Procedures:
- 1. Submit only information required by individual specification sections.
  - 2. Collect required information into a single submittal.
  - 3. Submit concurrently with related shop drawing submittal.
  - 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
- 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  - 2. Use of reproductions of Contract Documents in digital data form to create shop drawings is only permitted as defined in Division 01 and individual product sections.

3. Coordination: Show all field dimensions and relationships to adjacent or critical features of Work.
  4. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
  2. Samples will be reviewed for aesthetic, color, or finish selection.
  3. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
  4. Color Selection Samples: Architect will review and select colors for Project only after all colors are received, so that colors may be properly coordinated.
  5. Copies: Submit actual samples. Photographic or printed reproductions will not be accepted.
  6. Review of Field Samples: Review by Architect of field samples will be made for the following example products, as applicable, if not otherwise required and if requested by Contractor.
    - a. Concrete wall finishes and detailing (edges, corners and reveals).
    - b. Concrete paving colors and textures.
    - c. Gypsum board textures and finishes.
    - d. Field-applied paint colors and finishes.

### **3.16 SUBMITTAL REVIEW**

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
  1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
  1. Authorizing purchasing, fabrication, delivery, and installation:
    - a. "Approved", or language with same legal meaning.
    - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
      - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
      - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.

- 2) Non-responsive resubmittals may be rejected.
  - 2. Not Authorizing fabrication, delivery, and installation:
    - a. "Revise and Resubmit".
      - 1) Resubmit revised item, with review notations acknowledged and incorporated.
      - 2) Non-responsive resubmittals may be rejected.
    - b. "Rejected".
      - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
  - 1. Items for which no action was taken:
    - a. "Received" - to notify the Contractor that the submittal has been received for record only.
  - 2. Items for which action was taken:
    - a. "Reviewed" - no further action is required from Contractor.

**END OF SECTION**

**SECTION 01 30 00.01  
REQUEST FOR INTERPRETATION**

**RFI NUMBER:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**PROJECT NAME: BIG BEAR ADMINISTRATIVE FACILITY PROJECT NO.: 5-08-03**

**TO: RUHNAU CLARKE ARCHITECTS**

3775 Tenth Street, Riverside CA 92501 - 5751 Palmer Way, Suite C, Carlsbad, CA 92010

Attention: \_\_\_\_\_

Contractor: \_\_\_\_\_

Address: \_\_\_\_\_

**BRIEF SUMMARY OF RFI:** \_\_\_\_\_

Drawing No. \_\_\_\_\_ Detail No. \_\_\_\_\_

Specification Section \_\_\_\_\_ Title \_\_\_\_\_

.Page \_\_\_\_\_ Paragraph \_\_\_\_\_

**DETAILS OF THIS RFI:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SUGGESTED SOLUTION:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Response required by: \_\_\_\_\_ (min. 3 full days) Submitted By: \_\_\_\_\_

\_\_\_\_\_  
Organization: \_\_\_\_\_

**RESPONSE:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Attachments: \_\_\_\_\_

Response By: \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_  
Organization: \_\_\_\_\_

Copies: ☐ File ☐ Owner ☐ Structural ☐ Mechanical ☐ Plumbing ☐ Electrical  
☐ Civil ☐ Landscape ☐ other consultants

**END OF RFI**





## SUBMITTAL / SHOP DRAWING TRANSMITTAL

To:	Ruhnau Clarke Architects	Contractor's Submittal No.	
Attn:	<b>Construction Dept.</b>		
Contractor:		Project Name:	
Street:		RCA's Project No.	
City, State:		Subcontractor:	

CONTRACTOR TO FILL OUT THE FOLLOWING COVERING ONE COMPLETE SECTION OF THE SPECIFICATIONS ONLY:

Specification Section #:	Section Title:
--------------------------	----------------

<input type="checkbox"/>	Initial Submittal	Scheduled Date of Submittal	
<input type="checkbox"/>	1st Resubmittal	Scheduled Date of Submittal Return	
<input type="checkbox"/>	___ Resubmittal	Date Sent	
<input type="checkbox"/>	Submittal was a previously approved substitution.	Number of Copies	
	Approved Substitution Request Transmittal Form is enclosed.	Number of Samples	

CONTRACTOR COMPLETE EITHER (A) OR (B) FOLLOWING, <u>CHECK ONE</u> :	CONSTRUCTION MANAGERS CERTIFICATION		
(A) WE HAVE VERIFIED THAT THE MATERIAL OR EQUIPMENT CONTAINED IN THIS SUBMITTAL MEETS ALL THE REQUIREMENTS SPECIFIED OR SHOWN (NO EXCEPTIONS). <input type="checkbox"/>	THIS IS TO CERTIFY THAT THE CONSTRUCTION MANAGER IS REASONABLY CERTAIN THAT THE MATERIAL SPECIFIED IN THIS SUBMITTAL MEETS THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, AND THE SUBMITTAL IS COMPLETE PER THE CONTRACT DOCUMENTS.  SIGNATURE: _____ _____		
(B) WE HAVE VERIFIED THAT THE MATERIAL OR EQUIPMENT CONTAINED IN THIS SUBMITTAL MEETS ALL THE REQUIREMENTS SPECIFIED OR SHOWN, EXCEPT FOR THE FOLLOWING DEVIATIONS (LIST DEVIATIONS ON AN ATTACHED SHEET OR INDICATE DEVIATIONS CLEARLY ON SHOP DRAWINGS OR SUBMITTALS). <input type="checkbox"/>	<table><tr><th>CONTRACTORS CERTIFICATION</th></tr><tr><td>THIS IS TO CERTIFY THAT THE CONTRACTOR IS REASONABLY CERTAIN THAT THE MATERIAL SPECIFIED IN THIS SUBMITTAL MEETS THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.  SIGNATURE: _____ _____</td></tr></table>	CONTRACTORS CERTIFICATION	THIS IS TO CERTIFY THAT THE CONTRACTOR IS REASONABLY CERTAIN THAT THE MATERIAL SPECIFIED IN THIS SUBMITTAL MEETS THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.  SIGNATURE: _____ _____
CONTRACTORS CERTIFICATION			
THIS IS TO CERTIFY THAT THE CONTRACTOR IS REASONABLY CERTAIN THAT THE MATERIAL SPECIFIED IN THIS SUBMITTAL MEETS THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.  SIGNATURE: _____ _____			

### ARCHITECT'S USE ONLY BELOW THIS LINE.

Action:

☐ No Exception Taken    ☐ Make Corrections Noted    ☐ Rejected/Resubmit    ☐ Revise and Resubmit

Comments:

_____
_____
_____
_____
_____
_____
_____
_____

Date Received By RRC:

Date Sent to Consultant:

Structural \_\_\_\_\_

Mechanical \_\_\_\_\_

Electrical \_\_\_\_\_

Other \_\_\_\_\_

Date Received From:

Consultant \_\_\_\_\_

No. of Copies Received \_\_\_\_\_

Final Distribution: Contractor \_\_\_\_\_ Inspector \_\_\_\_\_ District/P.M. \_\_\_\_\_ Architect \_\_\_\_\_

Final Distribution Date: \_\_\_\_\_

**SECTION 01 31 14**  
**FACILITY SERVICES COORDINATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Services of a coordinator for facility services construction.
- B. Coordination documents.
  - 1. BIM Coordination drawings for the various trades of this project.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Responsibilities of separate contractors.
  - 1. Various types of Work to be coordinated, including Owner-Furnished / Contractor-Installed products.
- B. Section 01 30 00 - Administrative Requirements: Additional requirements for coordination.
- C. Section 01 60 00 - Product Requirements: Spare parts and maintenance materials.
  - 1. Coordination of products, especially general requirements for system completeness and product substitutions.
- D. Section 01 70 00 - Execution and Closeout Requirements: Starting of Systems. Systems Demonstration.
- E. Section 01 78 00 - Closeout Submittals: Project record documents.

**1.03 MECHANICAL AND ELECTRICAL COORDINATOR**

- A. Employ and pay for services of a person, technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.
  - 1. This designated individual may serve a dual role on the project team.

**1.04 SUBMITTALS**

- A. Submit name, address, and telephone number of coordinator and name of principal officer for review.
- B. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 COORDINATION REQUIRED**

- A. Coordinate the Work as stated in the Conditions of the Contract.
  - 1. Coordinate Work under the Contract with work under separate contracts by Owner.

2. Preinstallation Meetings: Coordinate and document work between trades. See Section 01 70 00 - Execution and Closeout Requirements.
  3. Cooperate with Owner, Owner Representative, and others as directed by Owner in scheduling and sequencing the incorporation into the Work of Owner Furnished / Contractor Installed (OFCI) products identified in the Contract Drawings and Specifications.
- B. Relationship of Documents:
1. Drawings, Specifications and other Contract Documents in the Project Manual are intended to be complementary.
  2. What is required by one shall be as if required by all.
  3. What is shown or required, or may be reasonably inferred to be required, or which is usually and customarily provided for similar work, shall be included in the Work.
- C. Discrepancies:
1. Error, omission, ambiguity or conflict in Drawings or Specifications shall be brought to Architect's attention during the bidding period, for Architect's determination and direction in accordance with provisions of the Conditions of the Contract.
- D. Construction Interfacing and Coordination: Layout, scheduling and sequencing of Work shall be solely the Contractor's responsibility.
1. Contractor shall verify, confirm and coordinate field measurements so that new construction correctly and accurately interfaces with conditions existing prior to construction.
- E. Contractor shall bring together the various parts, components, systems and assemblies as required for the correct interfacing and interpretation of all elements of the Work.
1. All work required to provide complete and fully operational systems shall be included in the contract price.
  2. Contractor shall coordinate Work to correctly and accurately connect abutting, adjoining, overlapping and related elements, including work under separate contracts by Owner, utility agencies and companies.
- F. Coordinate the work listed below:
1. Structural: Division 03, Division 04, Division 05, and Division 06.
  2. Architectural: Division 7, Division 8, Division 9, and Division 12.
  3. Specialties: Division 10.
  4. Equipment: Division 11.
    - a. Specialty Equipment.
  5. Plumbing: Division 22.
  6. Heating, Ventilating, and Air Conditioning: Division 23.
  7. Electrical: Division 26.
  8. Communications: Division 27.
  9. Electronic Safety and Security: Division 28.
  10. Site Utilities: Division 33.

- G. Coordinate progress schedules, including dates for submittals and for delivery of products.
- H. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- I. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.
- J. Coordination of subcontracts and separate contracts
  - 1. Superintendence of Work:
    - a. Contractor shall appoint a field superintendent and a project manager, who shall directly and full time supervise and coordinate all Work of the Contract.
  - 2. Subcontractors, Trades and Materials Suppliers:
    - a. Require all subcontractors, trades, crafts and suppliers to coordinate their portions of Work with the Contractor's field superintendent to prevent scheduling, sequencing, dimensional and other conflicts and omissions.
  - 3. Coordination with Work Under Separate Contracts:
    - a. Coordinate and schedule Work under the Contract with work being performed for Project under separate contracts by Owner, serving utilities and public agencies.
    - b. Make and facilitate direct contacts with parties responsible for work of the Project under separate contracts, in order to provide timely notifications and to facilitate information exchanges.

### **3.02 COORDINATION DOCUMENTS**

- A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.
  - 1. Produce BIM Drawings for the proposed installation and the placement of pipes, conduits, other materials, and the locations, size and reinforcement of penetrations in the building structure to conform to the structural Drawing and Specifications.
  - 2. Structural requirements take precedence when the requirements of the Mechanical, Electrical or other items are in conflict with structural.
  - 3. Take all precautions prior to coring into an existing building structure.
  - 4. Notify the structural engineer and obtain written approval prior to completing any structural penetrations if the structural integrity of an existing or new building structure may be compromised. Refer to Section 01 70 00 - Execution and Closeout Requirements for cutting and patching.
  - 5. Review limitations in available space for installation or service.
    - a. Overlay plans of each trade and verify space requirements and conflicts between trades.
    - b. Minor changes and adjustments that do not affect design intent may be made by Contractor and highlighted for Architect's review prior to purchase and installation.
  - 6. Incompatibility between items provided under different trades.

7. Inconsistencies between drawings, specifications and codes (between trades and within each trade).
- B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.
- C. Verify that utility, and other building system requirement characteristics of operating equipment are compatible with provided utilities, and other building systems.
  1. Coordinate work of various trades having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Identify electrical power characteristics and control wiring required for each item of equipment.
- E. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.
- F. After Architect review of original and revised documents, reproduce and distribute copies to concerned parties.

### **3.03 COORDINATION DRAWINGS / BIM MODEL**

- A. Building Information Modeling (BIM) is required for this Project, such as 3-D Clash Coordination. Submit a BIM Project Execution Plan for Program Project Manager and Design Professional review. The plan shall at minimum include the following items.
  1. Project Goals/ BIM uses and Objectives: Clear objective and goals. Align objectives with Construction Documents and Agreement.
  2. Project Information: Provide key project contacts including project name, contract type, delivery method, project description, project schedule, phases, and milestones.
    - a. Key Project Contacts:
      - 1) Project Managers.
      - 2) BIM Manager.
      - 3) Trade BIM Managers.
      - 4) Superintendents and other major project roles.
    - b. BIM and Trade BIM Managers must have at least two years of BIM experience of similar size projects.
    - c. Organizational Roles and Staffing: Define roles in each organization and specific responsibilities.
  3. BIM Information Exchanges:
    - a. Identify the information exchanges created as part of the planning process in the BIM Project Execution Plan.
    - b. Information exchanges are to illustrate the model elements by discipline, level of detail, and any specific attributes important to the project.
  4. Collaboration Procedures:
    - a. Develop Team electronic and activity collaboration procedures.
    - b. Includes model management and standard meeting actions and agendas.

5. Quality Control: Project teams should determine and document their overall strategy for quality control of the model.
6. Model Structure: The team must identify the methods to ensure model accuracy and comprehensiveness.
7. Project Deliverables: Identify project deliverables as required by Owner Representative.
8. Field Execution of final BIM product: Outline how the final BIM deliverables will be executed to reduce construction errors, change orders, and trade scheduling issues.

### **3.04 COORDINATION OF SUBMITTALS**

- A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.
- B. Check field dimensions and clearances and relationship to available space and anchors.
- C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.
- D. Check motor voltages and control characteristics.
- E. Coordinate controls, interlocks, wiring of switches, and relays.
- F. Coordinate wiring and control diagrams.
- G. When changes in the work are made, review their effect on other work.
- H. Verify information and coordinate maintenance of record documents.

### **3.05 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS**

- A. Review proposals and requests for substitution prior to submission to Architect.
- B. Verify compliance with Contract Documents and for compatibility with work of other sections.
- C. Submit with recommendation for action.

### **3.06 OBSERVATION OF WORK**

- A. Observe work for compliance with Contract Documents.
- B. Maintain a list of observed deficiencies and defects; promptly submit.

### **3.07 DOCUMENTATION**

- A. Observe and maintain a record of tests. Record:
  1. Specification section number and product name.
  2. Name of Contractor, subcontractor and special inspector.
  3. Name of testing agency and name of inspector.
  4. Name of manufacturer's representative present.
  5. Date, time, and duration of tests.
  6. Type of test, and results.
  7. Retesting required.
- B. Assemble background documentation for dispute and claim settlement.
- C. Submit copies of documentation to Architect upon request.

### **3.08 EQUIPMENT START-UP**

- A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 70 00.
- B. Observe start-up and adjustments, test run, record time and date of start-up, and results.
- C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.

### **3.09 INSPECTION AND ACCEPTANCE OF EQUIPMENT**

- A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.
- B. Assist Architect with review. Prepare list of items to be completed and corrected.

**END OF SECTION**

## **SECTION 01 32 16**

### **CONSTRUCTION PROGRESS SCHEDULE**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Responsibilities of individual Multi-Prime Contractors to coordinate with the AHJ's Master Project Schedule.
- B. Preliminary schedule.
- C. Construction progress schedule, with network analysis diagrams and reports.
- D. Summary schedule.
- E. Weekly/Short term (Look Ahead) Schedule.

##### **1.02 RELATED SECTIONS**

- A. Section 01 10 00 - Summary: Work sequence.
- B. Section 01 30 00 - Administrative Requirements: Submittal Schedule.

##### **1.03 REFERENCE STANDARDS**

- A. AGC (CPSM) - Construction Planning and Scheduling Manual.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM.

##### **1.04 SUBMITTALS**

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. Submit two copies to AHJ and one copy to Architect.
- C. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- D. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- E. Within 10 days after joint review, submit complete schedule.
- F. Submit updated schedule with each Application for Payment.
  - 1. Revise schedule also upon issuance of Change Orders and Construction Change Directives which substantially affect construction sequence or schedule.
- G. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- H. Submit under transmittal letter form specified in Section 01 30 00 - Administrative Requirements.



## 1.05 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one year's minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.
  - 1. Designate the Scheduler in writing and within ten (10) workdays after Notice of Intent to Award, as the qualified responsible person for preparation, maintenance, updating, and revision of all schedules for the full term of construction.
  - 2. Scheduler:
    - a. Dedicated to this project and available on-site as needed to meet the strict requirement of this spec. section.
    - b. All scheduling software and hardware located on-site.
    - c. Scheduler will attend all project meetings called for as specified in Section 01 30 00.
  - 3. Qualifications of responsible person:
    - a. Knowledge of critical path method (CPM) scheduling utilizing Primavera P6 latest release software.
  - 4. References:
    - a. Submit written reference of three (3) project Owners who have personal experience with this scheduler on previous projects.
    - b. Identify name, address, telephone number, project name, and cost.
  - 5. Owner Representative reserves the right to disapprove Scheduler when submitted by Contractor based on his/or her sole discretion. Owner Representative reserves the right to remove Scheduler from the project without cause.
- B. Contractor's Administrative Personnel: Three years minimum experience in using and monitoring CPM schedules on comparable projects.
- C. Reviews by Architect and AHJ: Reviews by Architect and AHJ will be to ascertain the general status of construction and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.
- D. Contractor's Review: All schedules shall be reviewed and approved by Contractor prior to submission for Architect's and AHJ's review.
- E. Changes and Deviations: Identify all deviations from requirements of Drawings and Specifications.
  - 1. Changes in the Work shall not be authorized by submittals review actions.
  - 2. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
  - 3. Changes shall only be authorized by separate written Change Order or Field Change Directive, in accordance with the Conditions of the Contract.

## **1.06 SCHEDULE FORMAT**

- A. Format: Prepare schedules in format at Contractor's option, either bar chart, PERT or GANTT format, providing clear indication of sequencing and scheduling of Work, for determination of "critical path" of construction progress.
  - 1. Prepare schedules in MS Project or Primavera.
  - 2. Provide clear indication of sequencing and scheduling of work for determination of "critical path" of construction progress.
  - 3. Present schedule in both electronic and reproducible paper formats with sheet size large enough to clearly read the characters.
- B. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- C. Diagram Sheet Size: Maximum 22 x 17 inches.
- D. Sheet Size: Multiples of 8-1/2 x 11 inches.
- E. Scale and Spacing: To allow for notations and revisions.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart.
- B. Prescheduling Conference:
  - 1. Owner Representative will conduct a conference within fifteen (15) work days after the Notice of Intent to Award to comply with requirements in Section 01 30 00 - Administrative Requirements.
    - a. Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
      - 1) Review software limitations and content and format for reports.
      - 2) Verify availability of qualified personnel needed to develop and update schedule.
      - 3) Discuss constraints, including phasing work stages area separations interim milestones and partial Owner occupancy.
      - 4) Review delivery dates for Owner-furnished products.
      - 5) Review schedule for work of Owner's separate contracts.
      - 6) Review submittal requirements and procedures.
      - 7) Review time required for review of submittals and resubmittals.
      - 8) Review requirements for tests and inspections by independent testing and inspecting agencies.
      - 9) Review Owner's IT requirements for installation of their Work.

- 10) Review time required for Project closeout and Owner startup procedures, including commissioning activities for MEP, Security Electronics Equipment.
  - 11) Review and finalize list of construction activities to be included in schedule.
  - 12) Review procedures for updating schedule.
- C. At the meeting, the Owner Representative will review scheduling requirements. These include schedule preparation, reporting requirements, labor and equipment loading, updates, revisions, and schedule delay analysis.
1. The Contractor will present schedule methodology, planned sequence of operations, resource loading methodology, and proposed activity coding structure.
- D. Coding structure:
1. Submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule.
  2. A minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/Construction and Responsibility/Subcontractor.
    - a. Refer to NETWORK DETAILS AND GRAPHICAL OUTPUT for listing of activity categories to be included in the schedule.

### **3.02 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
  1. Identify Work of separate buildings, phases, units or other logically grouped activities to facilitate review of Application for Payment with completed Work.
- D. Provide sub-schedules for each stage of Work identified in Section 01 10 00 - Summary.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and meetings in schedule.
- G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
  1. Format: Prepare Submittals Schedule in a format comparable to Construction Progress Schedule, specified in Article above.
  2. Content: List all items specified to be submitted, indicating submittal number (see instructions specified in Section 01 30 00 - Administrative Requirements, submittal type (i.e., product data, shop drawings, sample, quality control report, maintenance and operating data, etcetera), scheduled date submittal is to be made and date review should be complete in order to maintain construction on schedule.
  3. The Contractor shall submit to the Architect a schedule of the shop drawings that lists their required submission and approval dates.

- a. Allow minimum one (1) week for the Architect to review the submittals. Some submittals may require a longer review period. See Section 01 30 00 - Administrative Requirements.
  - b. Allow for the possibility that the consultant team will request revisions and resubmittal following the initial submittal.
  - c. The schedule shall encompass the entire construction period and will be revised by the Contractor and reviewed by the project team at each project meeting.
- 4. Changes and Deviations: Identify all deviations from requirements of Drawings and Specifications.
  - a. Changes in the Work shall not be authorized by submittals review actions.
  - b. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
  - c. Changes shall only be authorized by separate written Change Order or Construction Change Directive, in accordance with the Conditions of the Contract and Section 01 20 00 - Price and Payment Procedures.
- 5. Administration: Review of Submittals Schedules by Architect, AHJ, and Owner will be to ascertain the general status of submittals review and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.
  - a. Submit one copy each to AHJ and Architect.
  - b. Submit initial Submittals Schedule within 14 days of construction start date established in Notice to Proceed.
  - c. After review, resubmit Submittals Schedule within 10 days and thereafter submit updated Submittals Schedules at each Construction Progress Meeting.
- I. Indicate delivery dates for owner-furnished products.
- J. Coordinate content with schedule of values specified in Section 01 20 00 - Price and Payment Procedures.
  - 1. Include Submittals Schedule.
- K. Provide legend for symbols and abbreviations used.

### **3.03 BAR CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

### **3.04 NETWORK ANALYSIS**

- A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
- B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:

1. Preceding and following event numbers.
  2. Activity description.
  3. Estimated duration of activity, in maximum 15 day intervals.
  4. Project Milestones; include "Project Start" and "End Project" Millstones.
    - a. Schedule starts no earlier than the Project Duration (Day 1) will start on the Notice To Proceed (NTP) date.
  5. Earliest start date.
  6. Earliest finish date.
  7. Actual start date.
    - a. "Project Start" Milestone to have no predecessors and "End Project" Milestone has no successors.
    - b. "Project Start": Constrained by a "Mandatory Start" Milestone.
    - c. "End Project": Constrained by a "Mandatory Finish" Milestone.
    - d. No other activities on the schedule may have constraints, unless reviewed and approved by Owner Representative and Architect.
  8. Actual finish date.
  9. Latest start date.
  10. Latest finish date.
  11. Total and free float; float time shall accrue to Owner and to Owner's benefit.
    - a. Contractor does not own the float.
    - b. "Float time" refers to the time between earliest finish date and the latest finish date of each activity shown on the Construction Schedule.
    - c. Any float time indicated in the Construction Schedules required by this Section are to be held jointly by the Owner and Contractor.
    - d. Any delay (including Owner caused) encountered is to be subtracted from the available days ahead of progress against the Construction Schedule.
      - 1) Owner may claim float days equal to the delay until such float days are exhausted.
      - 2) No compensation of any type will be due the Contractor until the delay extends the overall project substantial completion date.
    - e. Weather (Rain) day requirements are as specified in the "Construction Services Agreement."
  12. Monetary value of activity, keyed to Schedule of Values.
  13. Percentage of activity completed.
  14. Responsibility.
- D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.
- E. Required Reports: List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest.

2. By amount of float, then in order of early start.

### **3.05 CREW SCHEDULES**

- A. Separate and concurrent with the Baseline Schedule, submit a schedule histogram depicting crew loading for Contractor's own labor forces and those of each subcontractor. Submit this crew schedule electronically.
- B. Provide the breakdown of a typical crew, by trade, for resource loading quantification.

### **3.06 WEATHER DAYS ALLOWANCE- AS ANTICIPATED BY THE CONTRACTOR**

- A. Based on historical weather in the local area, the Baseline Schedule shall include all non-work days on which the Contractor anticipates Work will not be performed due to adverse weather days that are anticipated to occur within the work day calendar and impact critical activities.
- B. The Contractor shall not receive any additional compensation for unavoidable delays due to inclement or unsuitable weather, and no time extension to complete any Contractual Completion Events as defined in General Conditions, will be considered due to inclement or unsuitable weather or conditions resulting there from.

### **3.07 REVIEW AND EVALUATION OF SCHEDULE**

- A. Review all schedules reviewed and approved by Contractor prior to submission for review by Architect and Owner.
- B. Participate in joint review and evaluation of schedule with Construction Manager and Architect at each submittal.
- C. Evaluate project status to determine work behind schedule and work ahead of schedule.
- D. After review, revise as necessary as result of review, and resubmit within 10 days.
- E. Review by Architect and Owner will be to ascertain the general status of construction and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.

### **3.08 SUMMARY SCHEDULE**

- A. Provide Summary Schedule, upon request, which consolidates groups of activities associated with Major Items of Work shown on Baseline Schedule.
  1. Summary Schedule is intended to give an overall indication of the project schedule without a large amount of detail.
  2. This schedule shall include the current status of each of the contract Milestones listed in the Agreement, and any significant activities that are critical to the completion of the Milestone work at the required time.
- B. Include in the Summary Schedule a separate Gantt Chart depicting only the critical path of the project at the time of the update.
- C. Updated and submitted monthly and with each Schedule Update or Schedule Revision.

### **3.09 WEEKLY (SHORT TERM LOOK-AHEAD) SCHEDULE**

- A. Submit to Owner Representative, twenty four (24) hours prior to each weekly progress meeting, a short term look ahead schedule showing the activities completed during the previous week and the schedule of activities for the following 4 weeks.

- B. Using the same computer software as the progress schedule, use the Activity ID's, Descriptions, and logic of the current progress schedule when producing a Weekly Schedule in CPM schedule or a bar chart format.
  - 1. In the event that the Weekly Schedule no longer conforms to the current schedule, Contractor may be required to revise either or both schedule(s).
- C. The activity designations used in the Weekly Schedule must be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.
- D. Contractor and Owner Representative must agree on the format of the Weekly Schedule.
- E. Weekly Schedule should indicate locations of work, critical activities, early start and early finish dates, actual start and actual finish dates, progress, and remaining durations for each activity in the three-week schedule.

### **3.10 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

### **3.11 ADJUSTMENT OF CONTRACT TIMES**

- A. Subject to the terms of General Conditions, contract time will be adjusted only for causes specified as generally described below.
  - 1. Non-excusable delay:
    - a. Includes actions or inactions of the Contractor, or events for which the Contractor has assumed contractual responsibility that would independently delay the completion of the Work beyond the current Contract completion date.
      - 1) This also includes actions or inactions of subcontractors, suppliers, or material manufacturers at any tier.
    - b. No time extensions will be granted for non-excusable delays.
  - 2. Excusable delay:
    - a. Events which are unforeseeable, outside the control of, and without the fault or negligence of either the Owner or the Contractor (or any party for whom either is responsible), which would independently delay the completion of the Work beyond the current Contract completion date.
    - b. The Contractor is entitled to a time extension only.
    - c. No other damages will be approved.

3. Compensable delay:
  - a. Actions or inactions of the Owner, or events for which the Owner has assumed contractual responsibility, which would independently delay the completion of the Work beyond the current Contract completion date.
  - b. The Contractor is entitled to a time extension and delay damages.
4. Concurrent delay:
  - a. Any combination of the above three (3) types of delay occurring on the same calendar date, or cases where the combination consists of two (2) or more instances of the same type of delay occurring on the same calendar date.
    - 1) Exception to concurrent delay:
      - (a) When one cause of delay is Owner-caused or caused by an event which is beyond the control and without the fault or negligence of either the Owner or the Contractor and the other Contractor-caused, the Contractor is entitled only to a time extension and no delay damages.
- B. If the Contractor believes that the Owner has impacted its work, such that the project completion date will be delayed, the Contractor must submit proof demonstrating the delay to the critical path.
  1. Proof, in the form of a Time Impact Analysis, may entitle the Contractor to an adjustment of Contract Time.
- C. Notify Owner Representative of a potential request for Contract Time adjustment within five (5) days of the start of the impact.
- D. The Contractor shall prepare and submit along with any Change Order Request (COR), response to Request for Proposal/Quote (RFP/RFQ), Differing Site Condition (DSC) notification or Request for Additional Compensation (RAC) a Time Impact Analysis (TIA) which includes both a written narrative and a schedule diagram depicting how the changed work may affect the progress of work and other schedule activities.
  1. The schedule diagram shall show how the Contractor proposes to incorporate the changed work in the schedule, and how it impacts the current updated schedule and critical path.
  2. The TIA shall not be resource constrained, or leveled using resource limits.
  3. Failure to include a TIA with the COR, Proposal, Quote, DSC or RAC shall constitute a waiver of the right to later claim any adjustment in time based upon changed or unforeseen Work.
- E. Time Impact Analysis (TIA):
  1. Use the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other Owner-caused delay). Represent the delay event in the schedule by:
    - a. Inserting new activities associated with the delay event into the schedule.
    - b. Revising activity logic.
    - c. Revising activity durations.



2. If the project schedule's critical path and milestone date(s) are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact without resource constraints may be warranted.
3. The Time Impact Analysis submittal must include the following information:
  - a. A fragment of the portion of the schedule affected by the delay event.
  - b. A narrative explanation of the delay issue and how it impacted the schedule.
  - c. A digital file containing the schedule file used to perform the Time Impact Analysis.
- F. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the Contractor chooses not to implement the revisions, the Contractor will be entitled to a time extension and no compensation for extended overhead.
- G. Indicate clearly that the Contractor has used, in full, all project float available for the work involved in the request, including any float that may exist between the Contractor's planned completion date and the Contract completion date.
  1. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the Contract Time.
- H. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the Contract completion date.
  1. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.
- I. Actual delays in activities which do not affect the critical path work or which do not move the Contractor's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the Contract Time.
- J. Submit request as specified with Contract Documents.
  1. In cases where the Contractor does not submit a request for Contract Time adjustment for a specific change order, delay, or Contractor request within the specified period of time, then it is mutually agreed that the particular change order, delay, or Contractor request has no time impact on the Contract completion date and no time extension is required.
- K. The Owner Representative will, within five (5) working days after receipt of a Contract Time adjustment, request any supporting evidence, review the facts, and advise the Contractor in writing.
  1. Include the new Progress Schedule data, if accepted by the Owner, in the next monthly Schedule Update.
  2. When the Owner has not yet made a final determination as to the adjustment of the Contract Time, and the parties are unable to agree as to the amount of the adjustment to be reflected in the Progress Schedule, reflect that amount of time adjustment in the Progress Schedule as the Owner Representative may accept as appropriate for such interim purpose.
    - a. It is understood and agreed that any such interim acceptance by the Owner Representative shall not be binding.

- b. Interim acceptance shall be made only for the purpose of continuing to schedule the Work
- c. Interim acceptance shall remain until such time as a final determination as to any adjustment of the Contract Time acceptable to the Owner Representative has been made.
- d. Revise the Progress Schedule prepared thereafter in accordance with the final decision.

### **3.12 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Construction Manager, Architect, Owner, and other concerned parties.
- B. Posting: Post one copy, minimum, of most recent Construction and Submittals Schedules in the Contractor's jobsite office, readily available to AHJ and Architect.
- C. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- D. Archive: Preserve a minimum of two copies of all superseded schedules, with a minimum of one copy available at job office for review by AHJ or Architect.

### **3.13 FINAL SCHEDULE SUBMITTAL**

- A. The final Schedule Update becomes the As-Built Schedule.
  - 1. The As-Built Schedule reflects the exact manner in which the project was constructed by reflecting actual logic, start and completion dates for all activities accomplished on the project.
  - 2. Contractor's Project Manager and Scheduler sign and certify the As-Built Schedule as being an accurate record of the way the project was actually constructed.
- B. Retainage will not be released until final Schedule Update is provided.

**END OF SECTION**

**SECTION 01 35 50**  
**REQUESTS FOR ELECTRONIC FILES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirements to request electronic construction document files from Architect.
- B. Hold Harmless Agreement form.

**1.02 RELATED SECTIONS**

- A. Section 01 30 00 - Administrative Requirements: Shop Drawings, Product Data and Samples.
- B. Section 01 70 00 - Execution and Closeout Requirements.
- C. Divisions 31 through 33 - Site Work.

**1.03 REQUIREMENTS**

- A. Electronic files have legal ramifications as information therein can be modified.
- B. In order to receive this electronic information, the following Hold Harmless Agreement form must be executed in its entirety, including signature by a company officer.
- C. Costs for processing and handling electronic files, however limited, will be \$250.00

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION.)**

**PART 3 - EXECUTION**

**3.01 ELECTRONIC FILE TRANSFER PROCEDURE**

- A. Submit a check in the amount of \$250.00 along with a list of the requested sheet numbers and an acknowledged copy of this waiver to the office of the Architect, Ruhnau Clarke Architects, 3775 Tenth Street, Riverside CA 92501 - 5751 Palmer Way, Suite C, Carlsbad, CA 92010.
- B. In order to expedite the transfer, upon receipt of a PDF copy of this acknowledgement, the requested CAD/Revit/BIM files will be sent in the form of a compact disc, DVD, or thumb drive to the recipient, as requested, by UPS, similar delivery service, or other method of electronic transfer after payment is received.
- C. It is expressly understood that any transfer is done as a courtesy and can be revoked at any time by the Architect.

Agreement is on next page

## HOLD HARMLESS AGREEMENT

### ARCHITECT'S PROJECT: BIG BEAR ADMINISTRATIVE FACILITY

### ARCHITECT'S PROJECT NUMBER: 5-08-03

We, \_\_\_\_\_, understand that we may be receiving electronic media containing design information, not necessarily intended for construction. We agree to hold Ruhnau Clarke Architects harmless for any defects in this data. We agree that it shall be our responsibility to reconcile this electronic data with the paper plans, and that only the paper plans shall be regarded as legal documents for the referenced project.

Further, the Contractor acknowledges that the Architect's reports, drawings, specifications, field data, field notes, laboratory test data, calculations, estimates and other similar documents are instruments of professional service, not products. In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professionals, the Parties listed above covenant and agree that all such drawings and data are instruments of service of the Design Professionals, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Parties agree that in accepting and utilizing any drawings and other data, that the Design Professionals waive all responsibility for any subsequent use of these data, the accuracy of dimensions, and the interpretation of information contained herein.

The Parties further agree not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Parties further agree to waive all claims against the Design Professionals resulting in any way from any unauthorized changes of the drawings and data or any other use other than for the project which is the subject of this Agreement.

The Contractor shall indemnify, defend and hold harmless the Design Professionals and its subconsultants and their officers, agents, employees from any claims, damages, losses, liabilities or expenses (including attorneys' fees) arising out of use of such documents without Consultant's prior written authorization.

Under no circumstances shall transfer of the drawings and other data be deemed a sale by the Design Professionals, and the Design Professionals make no warranties, either express or implied of the merchantability and fitness of the data for any particular purpose.

Sheet numbers or discipline requested: \_\_\_\_\_

Acknowledged by: Company Name \_\_\_\_\_

\_\_\_\_\_  
Signature of Company Officer

\_\_\_\_\_  
Print or Type Name

\_\_\_\_\_  
Date

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City, State, Zip Code

\_\_\_\_\_  
E-mail Address

**END OF SECTION**

## **SECTION 01 40 00 QUALITY REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Contractor Quality assurance submittals.
- B. Quality assurance.
- C. Testing and inspection agencies and services.
- D. Contractor's construction-related professional design services.
- E. Contractor's design-related professional design services.
- F. Control of installation.
- G. Mock-ups.
- H. Tolerances.
- I. Manufacturers' field services.
- J. Defect Assessment.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 41 00 - Regulatory Requirements: Compliance with applicable codes, ordinances and standards.
- C. Section 01 42 19 - Reference Standards.
- D. Section 01 45 33 - Code-Required Special Inspections: Testing laboratory services and inspections required by (Project City) (AHJ), during the course of construction.
- E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.
  - 1. Product options, substitutions, transportation and handling requirements, storage and protection requirements, and system completeness requirements.

#### **1.03 REFERENCE STANDARDS**

- A. IAS AC89 - Accreditation Criteria for Testing Laboratories.

#### **1.04 DEFINITIONS**

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
  - 1. Design Services Types Required:

- a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
- C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

#### **1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
  - 1. Temporary sheeting, shoring, or supports.
  - 2. Temporary scaffolding.
  - 3. Temporary bracing.
  - 4. Temporary falsework for support of spanning or arched structures.
  - 5. Temporary stairs or steps required for construction access only.
  - 6. Temporary hoist(s) and rigging.
  - 7. Investigation of soil conditions to support construction equipment.

#### **1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
  - 1. Structural Design of Formwork: As described in Section 03 10 00 - Concrete Forming and Accessories.
  - 2. Concrete Mix Design: As described in Section 03 30 00 - Cast-in-Place Concrete. No specific designer qualifications are required.

#### **1.07 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
  - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    - a. Full name.
    - b. Professional licensure information.
    - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

- C. Quality Control Submittals Schedule
  - 1. Schedule Format: Include quality control submittals on Submittals Schedule specified in accordance with General Conditions
  - 2. Schedule Content: List all tests, inspections and reports specified to be submitted, indicating submittal number, submittal type (field test, field inspection, fabrication inspection, etcetera), scheduled date of quality control activity and date report should be made.
- D. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
  - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
  - 2. Include required product data and shop drawings.
  - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
  - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- E. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Compliance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.
  - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- F. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
  - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- G. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- H. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
  1. Submit report in duplicate within 30 days of observation to Architect for information.
  2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- I. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
  1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
  2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

## **1.08 QUALITY ASSURANCE**

- A. Testing Agency Qualifications:
  1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  3. Qualification Statement: Provide documentation showing testing laboratory is approved by City Building Department.
  4. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in California.
- C. Contractor's Quality Control (CQC) Plan:
  1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
    - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
      - 1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.



- b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
  - 1) Management and control of documents and records relating to quality.
  - 2) Communications.
  - 3) Coordination procedures.
  - 4) Resource management.
  - 5) Process control.
  - 6) Inspection and testing procedures and scheduling.
  - 7) Control of noncomplying work.
  - 8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
  - 9) Control of testing and measuring equipment.
  - 10) Project materials certification.
  - 11) Managerial continuity and flexibility.
- c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
- d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
- D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

#### **1.09 REFERENCES AND STANDARDS - SEE SECTION 01 42 19**

#### **1.10 REGULATORY REQUIREMENTS FOR TESTING AND INSPECTION**

- A. Inspections, testing and approvals as required by authorities having jurisdiction. Refer to Section 01 41 00 - Regulatory Requirements and Section 01 45 33 - Code-Required Special Inspections.
- B. Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report requirements in preparing, fabricating, erecting, installing, applying, connecting and finishing Work.
- C. Deviations from Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviations are acceptable and appropriate for the Project.

### **1.11 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. Owner will employ and pay for services of an independent testing agency approved by DSA to perform other specified testing.
- B. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Contractor Employed Agency:
  - 1. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
  - 2. Laboratory: Authorized to operate in California.
  - 3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
  - 4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 CONTRACTOR'S QUALITY ASSURANCE**

- A. Quality Requirements: Work shall be accomplished in accordance with quality requirements of the Drawings and Specifications, including, by reference, all Codes, laws, rules, regulations and standards. When no quality basis is prescribed, the quality shall be in accordance with the best accepted practices of the construction industry for the locale of the Project, for projects of this type.
- B. Quality Control Personnel: Contractor shall employ and assign knowledgeable and skilled personnel as necessary to perform quality control functions to ensure that the Work is provided as required.

### **3.02 CONTROL OF INSTALLATION**

- A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects and fit for the intended use.
- B. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- C. Comply with manufacturers' instructions, including each step in sequence.
- D. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- E. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- F. Have work performed by persons qualified to produce required and specified quality.

- G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.
- I. Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements.
- J. Protection of Existing and Completed Work: Take all measures necessary to preserve and protect existing and completed Work free from damage, deterioration, soiling and staining, until Acceptance by the Owner.
- K. Verification of Quality: Work shall be subject to verification of quality by Owner, or Architect in accordance with provisions of the General Conditions of the Contract.
  - 1. Contractor shall cooperate by making Work available for inspection by Owner, Architect or their designated representatives.
  - 2. Such verification may include mill, plant, shop, or field inspection as required.
  - 3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
  - 4. Provide all information and assistance as required, including that by and from subcontractors, installers, fabricators, materials suppliers and manufacturers, for verification of quality by Owner, or Architect.
  - 5. Contract modifications, if any, resulting from such verification activities shall be governed by applicable provisions in the General Conditions.

### **3.03 MOCK-UPS**

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
  - 2. Make corrections as necessary until Architect's approval is issued.
- H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- J. Where possible salvage and recycle the demolished mock-up materials.

### **3.04 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### **3.05 TESTING AND INSPECTION**

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
  - 1. Test samples of mixes submitted by Contractor.
  - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 3. Perform specified sampling and testing of products in accordance with specified standards.
  - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 6. Perform additional tests and inspections required by Architect.
  - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

- c. To facilitate tests/inspections.
  - d. To provide storage and curing of test samples.
- 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 7. Inspections and Tests by Authorities Having Jurisdiction:
  - a. Contractor shall cause all tests and inspections to be made for Work under this Contract, as required by Building Departments, Department of Public Works, Fire Department, Health Department and similar agencies having jurisdiction.
  - b. Excepted as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.
- 8. Inspections and Tests by Serving Utilities:
  - a. Contractor shall cause all tests and inspections required by serving utilities to be made for Work under this Contract.
  - b. Scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### **3.06 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
  - 1. Observer subject to approval of Architect.
  - 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### **3.07 FIELD QUALITY CONTROL SUBMITTALS**

- A. Administration: Make all submittals to the Architect, unless otherwise directed.
- B. Submittal Identification: Identify each submittal by Specification Section number followed by a number indicating sequential submittal for that Section. Coordinate submittal numbers with submittals specified in Section 01 30 00 - Administrative Requirements.

1. Resubmittals shall use same number as original submittal, followed by a letter indicating sequential resubmittal.

03 30 00 - 1	First submittal for Section 03 30 00 - Cast in Place Concrete.
03 30 00 - 2	Second submittal for Section 03 30 00 - Cast in Place Concrete.
03 30 00 - 2A	Resubmittal of second submittal for Section 03 30 00 - Cast in Place Concrete.
03 30 00 - 2B	Second resubmittal of second submittal for Section 03 30 00 - Cast in Place Concrete.

- C. Project Identification: Title each submittal with Project name, submittal date and Architect's Project number.
- D. Copies: Provide PDF copies electronically transmitted or submit 6 copies, minimum, of reports of quality control reports on dry-process xerographic copies only.
- E. Contractor's Review:
  1. Submittals shall be made in accordance with requirements specified herein and in individual Sections.
  2. Indicate clearly on each submittal the specified or referenced values for each quality control activity and the values obtained.
  3. Note clearly and sign each submittal certifying that reported quality control activity "Conforms" or "Does Not Conform".
- F. Changes and Deviations:
  1. Identify all deviations from requirements of Drawings and Specifications.
  2. Changes in the Work shall not be authorized by submittals review actions.
  3. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
  4. Changes shall only be authorized by separate written Change Order or Construction Change Directive, in accordance with the General Conditions and 01 20 00 - Price and Payment Procedures.
- G. Record Submittals: When record submittals are specified, submit three copies or sets only. Record submittals will not be reviewed but will be retained for historical and maintenance purposes.
- H. Unsolicited Submittals: Unsolicited submittals will be returned unreviewed.

### **3.08 ARCHITECT'S REVIEW**

- A. General:
  1. Submitted Report review by Architect and Architect's consultants shall be only for general conformance with the design concept and requirements based on the information presented.
  2. Neither Architect nor Architect's consultants shall verify submitted quality control data.
- B. Contract Requirements:

1. Review by Architect and Architect's consultants shall not relieve the Contractor from compliance with requirements of the Drawings and Specifications.
  2. Changes shall only be authorized by separate written Change Order or Construction Change Directive, in accordance with the General Conditions and 01 20 00 - Price and Payment Procedures.
- C. Observations by Architect and Architect's Consultants: Periodic and occasional observations of Work in progress will be made by Architect and Architect's consultants as deemed necessary to review progress of Work and general conformance with design intent.

### **3.09 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements, at no change in Contract Sum or Contract Time.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.
- C. Architect's Acceptance and Rejection of Work: Architect reserves the right to reject all Work not in conformance to the requirements of the Drawings and Specifications.
- D. Acceptance of Non-Conforming Work: Acceptance of non-conforming Work, without specific written acknowledgement and approval of the Owner, shall not relieve the Contractor of the obligation to correct such Work.
1. Acceptance of structurally related non-conforming work shall be submitted to AHJ for review and approval.
- E. Contract Adjustment for Non-conforming Work:
1. Should Architect or Owner determine that it is not feasible or in Owner's interest to require non-conforming Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between Owner and Contractor.
  2. If equitable amount cannot be agreed upon, a Construction Change Directive will be issued and the amount in dispute resolved in accordance with applicable provisions of the General Conditions.
- F. Non-Responsibility for Non-Conforming Work: Architect and Architect's consultants disclaim any and all responsibility for Work produced not in conformance with the Drawings and Specifications.

### **END OF SECTION**

**SECTION 01 41 00**  
**REGULATORY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 AUTHORITY AND PRECEDENCE OF CODES, ORDINANCES AND STANDARDS**

- A. Authority: All codes, ordinances and standards referenced in the Drawings and Specifications shall have the full force and effect as though printed in their entirety in the Specifications.
- B. Precedence:
  - 1. Where specified requirements differ from the requirements of applicable codes, ordinances and standards, the more stringent requirements take precedence.
  - 2. Where the Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, the Drawings and Specifications take precedence so long as such increase is legal.
  - 3. Where no requirements are identified in the Drawings or Specifications, comply with all requirements of applicable codes, ordinances and standards of authorities having jurisdiction.
- C. Applicable Codes, Laws and Ordinances: Refer also to Section 01 10 00 - Summary, regarding permits and licenses.
  - 1. Performance of the Work is to be governed by all applicable laws, ordinances, rules and regulations of Federal, State and local governmental agencies and jurisdictions having authority over the Project, including accessibility requirements.
  - 2. Performance of the Work shall be accomplished in conformance with all rules and regulations of public utilities, utility districts and other agencies serving the development.
  - 3. Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to the execution date of the Agreement.
- D. Applicable Building Codes: References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the codes specified below, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction having authority over the Project.
- E. Performance of the Work shall meet or exceed the minimum regulatory requirements applicable to this project as summarized in this section, as adopted by City Building Department:
  - 1. Part 1, Title 24 CCR - 2022 California Administrative Code.
  - 2. Part 2, Title 24 CCR - 2022 California Building Code (CBC); Volumes 1 and 2.
    - a. Based on ICC (IBC) - ICC International Building Code, 2021.



- b. Effective dates of referenced standards are according to Chapter 35.
- 3. Part 3, Title 24 CCR - 2022 California Electrical Code.
  - a. 2023 is current use, use the CEC based on the NFPA 70-NEC 2020 edition as modified.
- 4. Part 4, Title 24 CCR - 2022 California Mechanical Code (CMC).
  - a. Based on IAPMO (UMC) - Uniform Mechanical Code, 2021.
- 5. Part 5, Title 24 CCR - 2022 California Plumbing Code (CPC).
  - a. Based on IAPMO (UPC) - Uniform Plumbing Code, 2021.
- 6. Part 6, Title 24 CCR - 2022 California Energy Code.
- 7. Part 8, Title 24 CCR - 2022 California Historical Building Code.
- 8. Part 9, Title 24 CCR - 2022 California Fire Code (CFC).
  - a. Based on ICC (IFC) - International Fire Code; 2021.
- 9. Part 10, Title 24 CCR - 2022 California Existing Buildings Code.
  - a. Based on ICC (IEBC) - ICC International Existing Buildings Code, 2021.
- 10. Part 11, Title 24 CCR - 2022 California Green Building Standards Code (CalGreen).
- 11. Part 12, Title 24 CCR - 2022 California Referenced Standards Code.
- F. Erosion and Sedimentation Control Regulations:
  - 1. California Codes and Regulations; Title 24, California Building Code, Parts 1 & 2.
  - 2. State of California State Water Resources Control Board Regulations.
  - 3. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.
- G. Maintain on site during construction, a copy of California Codes and Regulations; Title 24, California Building Code, Parts 1 through 5.

## **1.02 SUMMARY OF REFERENCE STANDARDS**

- A. Regulatory requirements applicable to this project are the following:
- B. California Referenced Standards Code: Chapter 12-7-4 Fire Resistive Standards, for fire rated doors.
- C. National Fire Protection Association (NFPA): (Partial List of Applicable Standards)
  - 1. Reference CBC for applicable NFPA Standards - 2021 CBC (SFM) Chapter 35.
  - 2. NFPA 72 - National Fire Alarm and Signaling Code (CA Amended); 2022, as amended in 2022 CBC Ch.35 Referenced Standards.
  - 3. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022 is current; use 2019 as indicated in 2022 CBC Ch. 35 Referenced Standards.
  - 4. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives; 2022 is current; use 2019 as indicated in 2022 CBC Ch.35 Referenced Standards..
  - 5. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

- D. 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services; Final Rule; Department of Justice.
- E. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice.
- F. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- G. ADA Standards - 2010 ADA Standards for Accessible Design.
- H. 29 CFR 1910 - Occupational Safety and Health Standards.

### **1.03 RELATED REQUIREMENTS**

- A. Section 01 40 00 - Quality Requirements.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 01 45 33 CODE-REQUIRED SPECIAL INSPECTIONS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 40 00 - Quality Requirements.
- C. Section 01 42 19 - Reference Standards.
- D. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

#### **1.03 DEFINITIONS**

- A. Code or Building Code: California Building Code and, more specifically, Chapter 17A - Structural Tests and Special Inspections, of same.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located. AHJ for this Project is City Building Department.
- C. Special Inspection:
  - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the CBC that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
  - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

#### **1.04 REFERENCE STANDARDS**

- A. ACI 318 - Building Code Requirements for Structural Concrete.
- B. AISC 341 - Seismic Provisions for Structural Steel Buildings.
- C. AISC 360 - Specification for Structural Steel Buildings.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

- F. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- G. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
- H. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- I. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- J. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- K. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- L. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.
- M. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- N. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage.
- O. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- P. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.
- Q. AWS D1.8/D1.8M - Structural Welding Code - Seismic Supplement.
- R. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- S. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck.
- T. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.
- U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
  - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
  - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- D. Manufacturer's Qualification Statement: Manufacturer is required to submit documentation of manufacturing capability and quality control procedures. Include documentation of AHJ approval.

- E. Fabricator's Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures.
- F. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one each to the distribution list.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of Special Inspector.
    - d. Date and time of special inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of special inspection.
    - h. Date of special inspection.
    - i. Results of special inspection.
    - j. Compliance with Contract Documents.
  - 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- G. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one each to the distribution list.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of Special Inspector.
    - d. Date and time of special inspection.
    - e. Identification of fabricated item and specification section.
    - f. Location in the Project.
    - g. Results of special inspection.
    - h. Verification of fabrication and quality control procedures.
    - i. Compliance with Contract Documents.
    - j. Compliance with referenced standard(s).
- H. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one each to the distribution list.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.

- d. Date and time of sampling or inspection.
  - e. Identification of product and specifications section.
  - f. Location in the Project.
  - g. Type of test or inspection.
  - h. Date of test or inspection.
  - i. Results of test or inspection.
  - j. Compliance with Contract Documents.
- 2. Test reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory.
    - a. Samples taken but not tested shall also be reported.
    - b. Records of special sampling operations as required shall also be reported.
    - c. Reports shall show that the material or materials were sampled and tested in accordance with the requirements of the CBC, and with the approved specifications.
    - d. They shall also state definitely whether or not the material or materials tested comply with requirements.
    - e. Test reports shall be issued within 14 days of finding being known, to all parties listed above.
- I. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
    - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
    - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
  - J. Manufacturer's Field Reports: Submit reports to Architect.
    - 1. Submit report in duplicate within 7 days of observation to Architect for information.
    - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.
  - K. Fabricator's Field Reports: Submit reports to Architect and AHJ.
    - 1. Submit report in duplicate within 30 days of observation to Architect for information.
    - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

#### **1.06 SPECIAL INSPECTION AGENCY**

- A. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

## **1.07 TESTING AND INSPECTION AGENCIES**

## **1.08 QUALITY ASSURANCE**

- A. Testing and inspection services which are performed shall be in accordance with requirements of the CBC, and as specified herein. Testing and inspection services shall verify that work meets the requirements of the Construction Documents.
- B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

## **1.09 INSPECTION BY THE OWNER**

- A. The Owner shall have the right to reject materials and workmanship which are defective, or to require their correction.
  - 1. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the Owner.
  - 2. If the Contractor does not correct such rejected work within a reasonable time, the Owner may correct such rejected work and charge the expense to the Contractor.
- B. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the completed work; the Contractor shall on request promptly furnish necessary facilities, labor and materials.
  - 1. If such work is found to be defective in any respect due to fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. .
  - 2. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL**

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
  - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
  - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

### **3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION (CHAPTER 22)**

- A. Structural Steel: Comply with quality assurance inspection requirements of CBC.

- B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).
- C. Inspect High Strength Bolt Installation per CBC 1706.2.1.
- D. Welding:
  - 1. Testing Laboratory will review welding procedure specifications as prepared by the fabricator.
  - 2. Structural Steel:
    - a. Inspect welding per CBC .
    - b. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M and AWS D1.8/D1.8M; continuous.
    - c. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M and BHMA A156.31; continuous.
    - d. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M and {rs\#1}; periodic.
    - e. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M and BHMA A156.31; continuous.
    - f. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M and BHMA A156.31; continuous.
  - 3. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 26.6.
    - a. Verification of weldability; periodic.
    - b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
    - c. Shear reinforcement; continuous.
    - d. Other reinforcing steel; periodic.
  - 4. Should defects appear in welds tested, repairs shall be similarly inspected at the Contractor's expense and at the direction of the Architect until satisfactory performance is assured.
  - 5. Other methods of inspection, for example, X-ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the Architect.
- E. Corrections:
  - 1. Correct deficiencies in structural steel work which inspections and test reports indicate to be not in compliance with the specified requirements.
  - 2. Perform additional tests required to reconfirm noncompliance of the original work and to show compliance of corrected work. Costs for all additional tests will be paid for by the Owner and backcharged to the Contractor.

### **3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION (CHAPTER 17 AND 19)**

- A. Reinforcement, Including Prestressing Tendons, and Verification of Placement: Verify compliance with ACI 318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.



- B. Inspection:
  - 1. Job Site Inspection: CBC 1705.3 and 1901.4.
- C. Reinforcing Steel, Including: Verify compliance with approved contract documents and ACI 318, Sections 20.2, 25.2 through 25.7, and 26.6.
  - 1. Reinforcing Bars: CBC 1901.4.
- D. Reinforcing Bar Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, 26.6.4; continuous.
  - 1. Verify weldability of reinforcing bars other than those complying with ASTM A706/A706M; periodic.
  - 2. Inspect single-pass fillet welds, maximum 5/16 inch; periodic.
  - 3. Inspect all other welds; continuous.
- E. Anchors Cast in Concrete: Verify compliance with ACI 318, 17.8.2; periodic.
- F. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ICC-ES AC308 approved report prior to and during placement of concrete; continuous.
  - 1. Comply with CBC Section 1910A.5; Table 1705A.3, items 4a & 4b, ASCE 7, Section 13.4.
- G. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.
  - 1. Comply with CBC Section 1910A.5; Table 1705A.3, items 4a & 4b, ASCE 7, Section 13.4.
  - 2. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
  - 3. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.
- H. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318; periodic.
- I. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with CBC Chapter 19, ACI 318, Sections 26.4.3, 26.4.4; periodic.
- J. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
  - 1. Slump.
  - 2. Air content.
  - 3. Temperature of concrete.
- K. Concrete Placement: Verify application techniques comply with approved Contract Documents and ACI 318, Chapter 26.5; continuous.
- L. Specified Curing Temperature and Techniques: Verify compliance with ACI 318, Chapter 26.5.3-26.5.5; continuous.
- M. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents, CBC Table 1705A.3, and modified ACI 318, Chapter 26.12.2,1(a).
  - 1. Beams and structural slabs, prior to removal of shores and forms; periodic.
- N. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Chapter 26.11.1.2(b); continuous.

- O. Welding of Reinforcing Bars: Conduct special inspections and verify Special Inspector's qualifications in accordance with requirements of AWS D1.4/D1.4M.
- P. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI 318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI 318, Chapters 19 and 20. CBC 1705A.3.

### **3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION (CHAPTER 21)**

- A. Masonry Structures Subject to Special Inspection:
  - 1. Masonry construction when required by the quality assurance program of TMS 402/602.
  - 2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".
- B. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
  - 1. Inspections and Approvals:
    - a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
    - b. Verify approval of submittals required by Contract Documents; periodic.
  - 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
  - 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
  - 4. Joints and Accessories: When masonry construction begins, verify:
    - a. Proportions of site prepared mortar; periodic.
    - b. Construction of mortar joints; periodic.
    - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
  - 5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
    - a. Size and location of structural elements; periodic.
    - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
    - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
    - d. Welding of reinforcing bars; continuous.
    - e. Preparation, construction and protection of masonry against hot weather above 90 degrees F and cold weather below 40 degrees F; periodic.
  - 6. Grouting Preparation: Prior to grouting, verify:
    - a. Grout space is clean; periodic.
    - b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.

- c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
- d. Correctly constructed mortar joints; periodic.
- 7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.
  - a. Comply with CBC 2105A.2 Compressive Strength.

### **3.05 SPECIAL INSPECTIONS FOR SOILS**

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
  - 1. Design bearing capacity of material below shallow foundations; periodic.
  - 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
  - 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
  - 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.
- C. Excavations, Foundations and Retaining Walls (Chapters 17, 18, and 33):
  - 1. Earth Compaction: CBC 1705.6; Table 1705.6, periodic; 1804.6.
  - 2. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill: CBC 1705.6; Table 1705.6, continuous; 1804.6.
- D. The Geotechnical Engineer of record or a Geotechnical Engineer selected by the Owner will provide continuous inspection of fill and will field test fill and earth backfill as placed and compacted, and inspect excavations and subgrade before concrete is placed and provide periodic inspection of open excavations, embankments, and other cuts or vertical surfaces of earth.
  - 1. The Geotechnical Engineer will submit a Verified Report indicating observations, tested fills, and opinion the fills were placed in accordance with the project specifications.
- E. Contractor shall remove unsatisfactory material, re-roll, adjust moisture, place new material, or in the case of excavations, provide proper protective measures, perform other operations necessary, as directed by the Geotechnical Engineer whose decisions and directions will be considered final.
- F. Soils Test and Inspection Procedure:
  - 1. Allow sufficient time for testing, and evaluation of results before material is needed. The Geotechnical Engineer shall be sole and final judge of suitability of all materials.
  - 2. Laboratory compaction tests to be used will be in accordance with ASTM D1557.
  - 3. Field density tests will be made in accordance with ASTM D1556/D1556M.
  - 4. Number of tests will be determined by Geotechnical Engineer. Materials in question may not be used pending test results.
  - 5. Excavation and embankment inspection procedure. Geotechnical Engineer will visually or otherwise examine such areas for bearing values, cleanliness and suitability.

6. Earthwork Test Reports: In order to avoid misinterpretations by the reviewing agencies, all retest results shall be reported on the same sheet, immediately following the previous failure test to which it is related. Retests shall be clearly noted as such.

### **3.06 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS**

- A. Verify penetration firestops in accordance with ASTM E2174.
- B. Verify fire resistant joints in accordance with ASTM E2393.
- C. Inspection: Comply with CBC 1705A.17.

### **3.07 SPECIAL INSPECTIONS FOR FIRE DOOR ASSEMBLIES**

- A. Per NFPA 80 5.2.1:
  1. Provide a third party inspector not associated with the construction, supply or installation of this project to develop a field survey of the doors and hardware.
  2. Survey is to be done by a member certified as a FDAI (Fire Door Assembly Inspector), Certified AHC (Architectural Hardware Consultant) or a certified testing laboratory: UL or Intertek.
  3. Certified Inspectors may be found at DHI.org, Intertek, or CAFDI.org.

### **3.08 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE**

- A. Inspection: Comply with CBC 1705.12.
- B. Testing: Comply with CBC 1705.13.
- C. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.
- D. Cold Formed Steel Light Frame Construction:
  1. Field welding; periodic.
  2. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system; periodic.
- E. Storage Racks and Access Floors: Anchorage; periodic.
- F. Architectural Components: Erection and fastening of components below; periodic.
  1. Exterior cladding; per ICC ESR Report when applicable.
  2. Interior and exterior veneer.
  3. Interior and exterior non-loadbearing walls and partitions.
  4. Suspended ceiling systems and their anchorage, per ICC ESR Report. CBC Section 1705.12.5 and 1705.13.
- G. Mechanical and Electrical Components:
  1. Anchorage of electric equipment required for emergency or standby power systems; periodic.
  2. Installation and anchorage of other electrical equipment; periodic.
  3. Vibration isolation systems where the approved Contract Documents require a nominal clearance of 1/4 inch or less between support frame and seismic restraint; periodic.

4. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed.
  - a. Verify clearances have been provide as required by Section 13.2.3 of ASCE 7.
  - b. Verify nominal clearance of 3 inches has been provided between fire protection sprinkler drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.
- H. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.
- I. Structural Testing for Seismic Resistance:
  1. Concrete reinforcement: Comply with ACI 318, Section 20.2.2.5 and 21.1.5.2.
    - a. Materials Obtain mill certificates demonstrating compliance with ASTM A615/A615M; periodic.
    - b. Welding: Perform chemical tests complying with ACI 318, Section 26.6.4 to determine weldability; periodic.
  2. Structural Steel: Comply with the quality assurance requirements of AISC 341.
  3. Non-Structural Components:
    - a. General Design Requirements: Obtain manufacturer certification of compliance with requirements of ASCE 7, Section 13.2.1; periodic.
    - b. Designated Seismic Force-Resisting Non-Structural System Components: Obtain manufacturer certification of compliance with ASCE 7, Section 13.2.2; periodic.
- J. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

### **3.09 SPECIAL INSPECTIONS FOR WIND RESISTANCE**

- A. Cold-Formed Steel Light Frame Construction:
  1. Field welding; periodic.
  2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic
- B. Wind Resisting Components:
  1. Roof covering, roof deck, and floor framing connections; periodic.
  2. Exterior wall covering and wall connections to roof and floor diaphragms and framing; periodic.
- C. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

### **3.10 STRUCTURAL OBSERVATIONS FOR STRUCTURES**

- A. Provide Observations: For structure where one or more of the following conditions exist:
  1. Such observation is required by the registered design professional responsible for the structural design.
  2. Such observation is specifically required by AHJ.

### **3.11 SPECIAL ARCHITECTURAL INSPECTIONS**

#### **A. Signs and/or identification devices:**

1. Prior to issuance of a final Certificate of Occupancy, Enforcing Agency shall verify installation of signs for information content, appearance, location and Braille per CBC 11B-703.1.1.2.
  - a. Inspection shall include, but not limited to:
    - 1) Braille dots and cells are properly spaced and the size proportion and type raised characters are in compliance with these regulations.
    - 2) Tactile exit signage per CBC 1013.4 and 11B-216.4.1 Exit doors.
    - 3) Tactile floor designation signs in stairways per CBC 1023.9 Stairway identification signs.
    - 4) Tactile special egress control device signs per CBC 1010.1.9.7 Delayed Egress Locks, item 5.1.
    - 5) Elevator car control identification per CBC 11B-407.4.6-8 Elevator car controls.
    - 6) Sanitary facilities signage per CBC 11B-216.8 Toilet rooms and bathing rooms; and 11B-703.7.2.6 Toilet and bathing facilities geometric symbols.

#### **B. Water-resistive barrier coating:**

1. Installation over sheathing substrate per ASTM E2570/E2570M.

#### **C. Glass and glazing identification:**

1. Verify installation of manufacturer's material mark inspection per CBC 2403.1.
  - a. Safety glazing shall be labeled per CBC 2406.3.

### **3.12 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES**

#### **A. Special Inspection Agency shall:**

1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified reference standards.
4. Ascertain compliance of materials and products with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
6. Perform additional tests and inspections required by Architect.
7. Submit reports of all tests or inspections specified.

#### **B. Limits on Special Inspection Agency Authority:**

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.

3. Agency may not assume any duties of Contractor.
  4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### **3.13 TESTING AGENCY DUTIES AND RESPONSIBILITIES**

- A. Testing Agency Duties:
1. Test samples submitted by Contractor.
  2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  3. Perform specified sampling and testing of products in accordance with specified standards.
  4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
  6. Perform additional tests and inspections required by Architect.
  7. Attend preconstruction meetings and progress meetings.
  8. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Agency may not approve or accept any portion of the work.
  3. Agency may not assume any duties of Contractor.
  4. Agency has no authority to stop the work.
- C. Immediately upon determination of a test failure, the Laboratory shall telephone the results to the Architect. On the same day, Laboratory shall send test results by email to the Architect and to all relevant responsible parties of the project team, and Owner's Inspector
- D. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- E. Contractor will pay for re-testing required because of non-compliance with specified requirements.
- F. At the completion of the project, Testing Laboratory shall certify in writing and on all required AHJ forms, that all work specified or required to be tested and inspected conforms to drawings, specifications and applicable building codes.

### **3.14 CONTRACTOR DUTIES AND RESPONSIBILITIES**

- A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.

2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to work to be tested or inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
    - c. To facilitate tests or inspections.
    - d. To provide storage and curing of test samples.
  4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
  5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  6. The Contractor shall notify the Owner's Inspector a minimum of 5 working days in advance of the manufacture of material to be supplied by him under the Contract Documents, which must be by terms of the Contract be tested, in order that the Owner may arrange for the testing of such material at the source of supply.
  7. Material shipped by the Contractor from the source of supply before having satisfactorily passed such testing and inspection or before the receipt of notice from said Inspector that such testing and inspection will not be required, shall not be incorporated in the Project.
  8. The Owner will select and pay testing laboratory costs for all tests and inspections, but may be reimbursed by the Contractor for such costs under the Contract conditions. Any direct payments by the Contractor to the testing laboratory on this project is prohibited.
- B. Contractor shall submit a written statement of responsibility to comply with CBC section 1704A.4.
1. Each contractor responsible for the construction of a main wind- or seismic-force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
    - a. Acknowledgment of awareness of the special requirements contained in the statement of special inspections;
    - b. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official;
    - c. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports; and
    - d. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.



- C. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- D. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- E. Unless otherwise directed, materials not conforming to the requirements of Contract Documents shall be promptly removed from the Project site.

### **3.15 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES**

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
  - 1. Observer subject to approval of Architect.
  - 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### **END OF SECTION**

**SECTION 01 50 00**  
**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary telecommunications services.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Security requirements.
- E. Waste removal facilities and services.
- F. Project identification sign.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 35 53 - Security Procedures
- B. Section 01 57 19 - Temporary Environmental Controls: Filtration requirements during construction and final cleaning.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 1. Use 2016 as indicated in 2019 CBC Referenced Standards.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

**1.04 TEMPORARY UTILITIES**

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. New permanent facilities may be used.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.05 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:

**1.06 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
  - 1. Provide temporary toilet facilities if maximum number of personnel on project is greater than 10.
  - 2. Submit proposed location of temporary toilet(s) to AHJ for approval.

- a. Place on-site portable toilets away from building air intakes and entryway.
- B. Maintain daily in clean and sanitary condition.

#### **1.07 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

#### **1.08 FENCING**

- A. Construction: Contractor's option.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

#### **1.09 EXTERIOR ENCLOSURES**

- A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

#### **1.10 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
  - 1. STC rating of 35 in accordance with ASTM E90.
  - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Paint surfaces exposed to view from Owner-occupied areas.

#### **1.11 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.
  - 1. Include construction surveillance camera system per the Owner.

#### **1.12 CAFETERIA AND FOOD**

- A. Construction personnel shall police their own areas. All cups, cans, paper, wrappers, and discarded food must be placed in trash receptacles at end of each break.

- B. Contractor(s) shall submit to AHJ proposed location of any break areas and eating areas for approval.

#### **1.13 SMOKING AND TOBACCO**

- A. Smoking and vaping is not permitted on property.
- B. No chewing tobacco or spitting of tobacco is permitted.

#### **1.14 VEHICULAR ACCESS AND PARKING**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

#### **1.15 WASTE REMOVAL**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

#### **1.16 PROJECT IDENTIFICATION**

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.

#### **1.17 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Provide separate private office similarly equipped and furnished, for use of Owner.
- D. Provide separate private office similarly equipped and furnished, for use of Architect and Owner.
- E. Locate offices a minimum distance of 30 feet from existing and new structures.

### **1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 57 13**  
**TEMPORARY EROSION AND SEDIMENT CONTROL (SWPP)**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

**1.02 SUMMARY**

- A. The Grading Prime Contractor is to file with the State of California, State Water Resources Control Board a Notice of Intent (N.O.I.) to comply with the terms of the General Permit to Discharge Storm Water Associated with Construction Activity, prior to the beginning of construction on this site.
  - 1. Prepare, implement, and monitor the Storm Water Pollution Prevention Plan (SWPPP) prepared for this site.
  - 2. It is required to review the storm water pollution prevention plan and to identify possible pollution sources and mitigation measures with all subcontractors at their starting of work on site.
- B. The Contractor will be obligated to comply with the requirements of the State's General Permit. Any fines or penalties due to failure to comply with the general permit shall be borne by the Contractor.
- C. Storm water pollution prevention plan testing and reporting will be performed by the Contractor until such responsibility is reassigned by the Owner.

**1.03 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.
- B. Section 31 10 00 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- C. Section 31 22 00 - Grading: Temporary and permanent grade changes for erosion control.
- D. Section 32 11 23 - Aggregate Base Courses: Temporary and permanent roadways.

**1.04 REFERENCE STANDARDS**

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.

- B. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
- G. California Codes and Regulations; Title 24, California Building Code, Parts 1 & 2.
- H. State of California State Water Resources Control Board Regulations.
- I. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit.

#### **1.05 PERFORMANCE REQUIREMENTS**

- A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP).
- B. Also comply with all more stringent requirements of State of California Erosion and Sedimentation Control Manual.
- C. Comply with all requirements of WQMP for erosion and sedimentation control.
- D. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
  - 1. Owner will obtain permits and pay for securities required by authority having jurisdiction.
  - 2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- F. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.
- G. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
  - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
  - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

- I. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
  - 1. Control movement of sediment and soil from temporary stockpiles of soil.
  - 2. Prevent development of ruts due to equipment and vehicular traffic.
  - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
  - 1. Prevent windblown soil from leaving the project site.
  - 2. Prevent tracking of mud onto public roads outside site.
  - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
  - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- K. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
  - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
  - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- L. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
  - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- M. Open Water: Prevent standing water that could become stagnant.
- N. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

#### **1.06 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Comply with pertinent provisions of the general permit.
- C. Erosion and Sedimentation Control Plan:
  - 1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
  - 2. Include:
    - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
    - b. Measurements of existing turbidity of waterways.



- c. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
  - d. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
  - e. Schedule of temporary preventive measures, in relation to ground disturbing activities.
  - f. Other information required by law.
  - g. Format required by law is acceptable, provided any additional information specified is also included.
- 3. Obtain the approval of the Plan by authorities having jurisdiction.
  - 4. Obtain the approval of the Plan by Owner.
- D. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
  - E. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
  - F. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Final Inspection.

## **PART 2 PRODUCTS**

### **2.01 NOT USED - REFER TO SWPP FOR MATERIALS.**

### **2.02 MATERIALS**

- A. Mulch: Use one of the following:
  - 1. Straw or hay.
  - 2. Wood waste, chips, or bark.
  - 3. Erosion control matting or netting.
  - 4. Cutback asphalt.
  - 5. Polyethylene film, where specifically indicated only.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Bales: Air dry, rectangular straw bales.
  - 1. Cross Section: 14 by 18 inches, minimum.
  - 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet long:
  - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
  - 2. Wood, 2 by 2 inches in cross section.

- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
  - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
  - 2. Permittivity:  $0.05 \text{ sec}^{-1}$ , minimum, when tested in accordance with ASTM D4491/D4491M.
  - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
  - 4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
  - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
  - 6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
  - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
  - 8. Manufacturers:
    - a. TenCate: [www.tencate.com](http://www.tencate.com).
    - b. North American Green: [www.nagreen.com](http://www.nagreen.com).
    - c. Propex Geosynthetics: [www.geotextile.com](http://www.geotextile.com)
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Silt Fence Posts: One of the following, minimum 5 feet long:
  - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
  - 2. Softwood, 4 by 4 inches in cross section.
  - 3. Hardwood, 2 by 2 inches in cross section.
- G. Gravel: See Section 32 11 23 for aggregate.
- H. Riprap: See Section 31 37 00.
- I. Concrete: See Section 03 30 00.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.
- B. Correct conditions detrimental to timely and proper completion of the work.
- C. Do not proceed until unsatisfactory conditions are corrected.

### **3.02 PREPARATION**

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

### 3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
  - 1. Width: As required; 20 feet, minimum.
  - 2. Length: 50 feet, minimum.
  - 3. Provide at each construction entrance from public right-of-way.
  - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
  - 1. Provide linear sediment barriers:
    - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
    - b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
    - c. Along the toe of cut slopes and fill slopes.
    - d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
    - e. Across the entrances to culverts that receive runoff from disturbed areas.
  - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
    - a. Slope of Less Than 2 Percent: 100 feet..
    - b. Slope Between 2 and 5 Percent: 75 feet.
    - c. Slope Between 5 and 10 Percent: 50 feet.
    - d. Slope Between 10 and 20 Percent: 25 feet.
    - e. Slope Over 20 Percent: 15 feet.
- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
  - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
  - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- G. Soil Stockpiles: Protect using one of the following measures:
  - 1. Cover with polyethylene film, secured by placing soil on outer edges.
  - 2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.
- H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.
- I. Temporary Seeding: Use where temporary vegetated cover is required.

### **3.04 INSTALLATION**

- A. Installation of the work shall be as indicated on the Drawings as specified herein and regulatory requirements.
- B. Maintain the protection up to the project completion.
- C. Traffic-Bearing Aggregate Surface:
  1. Excavate minimum of 6 inches.
  2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
  3. Place and compact at least 6 inches of 1 1/2 to 3 1/2 inch diameter stone.
- D. Silt Fences:
  1. Store and handle fabric in accordance with ASTM D4873/D4873M.
  2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
  3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
  4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
  5. Install with top of fabric at nominal height and embedment as specified.
  6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
  7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
  8. Fasten fabric to wood posts using one of the following:
    - a. Four nails per post with 3/4 inch diameter flat or button head, 1 inch long, and 14 gauge, 0.083 inch shank diameter.
    - b. Five staples per post with at least 17 gauge, 0.0453 inch wire, 3/4 inch crown width and 1/2 inch long legs.
  9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
  10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- E. Straw Bale Rows:
  1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.

2. Install bales so that bindings are not in contact with the ground.
  3. Embed bales at least 4 inches in the ground.
  4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
  5. Fill gaps between ends of bales with loose straw wedged tightly.
  6. Place soil excavated for trench against bales on the upslope side of the row, compacted.
- F. Mulching Over Small and Medium Areas:
1. Dry Straw and Hay: Apply 4 to 6 inches depth.
  2. Wood Waste: Apply 2 to 3 inches depth.
  3. Asphalt: Apply 1/4 gallon per square yard.
  4. Erosion Control Matting: Comply with manufacturer's instructions.
- G. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
  2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
  3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
  4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
  5. Incorporate fertilizer into soil before seeding.
  6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
  7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
  8. Repeat irrigation as required until grass is established.

### **3.05 MAINTENANCE**

- A. During and upon completion of the work comply with the general provisions of the general permit.
- B. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- C. Repair deficiencies immediately.
- D. Silt Fences:
1. Promptly replace fabric that deteriorates unless need for fence has passed.
  2. Remove silt deposits that exceed one-third of the height of the fence.
  3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Straw Bale Rows:
1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.

2. Remove silt deposits that exceed one-half of the height of the bales.
  3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- F. Clean out temporary sediment control structures weekly and relocate soil on site.
- G. Place sediment in appropriate locations on site; do not remove from site.

### **3.06 CLEAN UP**

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

### **END OF SECTION**

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Building flush-out after construction and before occupancy.
- B. Testing indoor air quality before commencement of construction; existing building areas only.
- C. Testing indoor air quality after completion of construction.
- D. Testing air change effectiveness after completion of construction.

**1.02 PROJECT GOALS**

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
  - 1. Cover duct openings and protect mechanical equipment during construction. Provide tape, plastic, sheet metal or other methods acceptable to AHJ.
    - a. Comply with California Green Code Section 5.504.3.
  - 2. Cleaning of ductwork is not contemplated under this Contract.
  - 3. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
  - 4. Establish condition of existing ducts and equipment prior to start of alterations.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
  - 1. Furnish products meeting the specifications.
  - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

**1.03 RELATED REQUIREMENTS**

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Section 01 50 00 - Temporary Facilities and Controls: Temporary construction requirements.
- C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- D. Section 01 91 13 - General Commissioning Requirements: Verification of installed Work and it's performance.
- E. Section 01 91 14 - Commissioning Authority Responsibilities.
- F. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): HVAC filters.
- G. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.
- H. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Cleaning air ducts, equipment, and terminal units.

#### **1.04 REFERENCE STANDARDS**

- A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- B. ASHRAE Std 129 - Measuring Air-Change Effectiveness.
- C. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology).
- D. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
- E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.
- F. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
- G. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air.
- H. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction.

#### **1.05 DEFINITIONS**

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

#### **1.06 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Indoor Air Quality Management Plan: Describe, in detail, measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
  - 1. Submit not less than 60 days before enclosure of building.
  - 2. Identify potential sources of odor and dust.
  - 3. Identify construction activities likely to produce odor or dust.
  - 4. Identify areas of project potentially affected, especially occupied areas.
  - 5. Evaluate potential problems by severity and describe methods of control.
  - 6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
  - 7. Describe cleaning and dust control procedures.
  - 8. Describe coordination with commissioning procedures.
- C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.



- D. Duct and Terminal Unit Inspection Report.
- E. Air Contaminant Test Plan: Identify:
  - 1. Testing agency qualifications.
  - 2. Locations and scheduling of air sampling.
  - 3. Test procedures, in detail.
  - 4. Test instruments and apparatus.
  - 5. Sampling methods.
- F. Air Contaminant Test Reports: Show:
  - 1. Location where each sample was taken, and time.
  - 2. Test values for each air sample; average the values of each set of 3.
  - 3. HVAC operating conditions.
  - 4. Certification of test equipment calibration.
  - 5. Other conditions or discrepancies that might have influenced results.
- G. Ventilation Effectiveness Test Plan: Identify:
  - 1. Testing agency qualifications.
  - 2. Description of test spaces, including locations of air sampling.
  - 3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
  - 4. Test instruments and apparatus; identify tracer gas to be used.
  - 5. Sampling methods.
- H. Ventilation Effectiveness Test Reports: Show:
  - 1. Preliminary tests of instruments and apparatus and of test spaces.
  - 2. Calculations of ventilation effectiveness, variable "E".
  - 3. Location where each sample was taken, and time.
  - 4. Test values for each air sample.
  - 5. HVAC operating conditions.
  - 6. Other information specified in ASHRAE Std 129.
  - 7. Other conditions or discrepancies that might have influenced results.

## **1.07 QUALITY ASSURANCE**

- A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Low VOC Materials: See Section 01 61 16.
- B. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

- C. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

## **PART 3 EXECUTION**

### **3.01 CONSTRUCTION PROCEDURES**

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
  - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
  - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
  - 3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
- D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.
- E. HVAC equipment and supply air ductwork may be used for ventilation during construction:
  - 1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
  - 2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
  - 3. Do not use return air ductwork for ventilation unless absolutely necessary.
  - 4. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.
- F. Do not store construction materials or waste in mechanical or electrical rooms.
- G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
  - 1. Inspect duct intakes, return air grilles, and terminal units for dust.
  - 2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
  - 3. Clean tops of doors and frames.
  - 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
  - 5. Clean return plenums of air handling units.
  - 6. Remove intake filters last, after cleaning is complete.
- H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

### **3.02 BUILDING FLUSH-OUT**

- A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
- B. Perform building flush-out before occupancy.
- C. Do not start flush-out until:
  - 1. All construction is complete.
  - 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
  - 3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
  - 4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
  - 5. New HVAC filtration media have been installed.
- D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
  - 1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
  - 2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
  - 3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
  - 4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
    - a. Begin ventilation at least three hours prior to daily occupancy.
    - b. Continue ventilation during all occupied periods.
    - c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.
- E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

### **3.03 AIR CONTAMINANT TESTING**

- A. Contractor's Option: Either full continuous flush-out, or satisfactory air contaminant testing is required, not both.
- B. Perform air contaminant testing before starting construction, as base line for evaluation of post-construction testing.
- C. Perform air contaminant testing before occupancy.
- D. Do not start air contaminant testing until:
  - 1. All construction is complete, including interior finishes.
  - 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
  - 3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
  - 4. New HVAC filtration media have been installed.

- E. Indoor Air Samples: Collect from spaces representative of occupied areas:
  - 1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
  - 2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
  - 3. Collect samples from height from 36 inches to 72 inches above floor.
  - 4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
  - 5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
  - 6. When retesting the same building areas, take samples from at least the same locations as in first test.
- F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.
- G. Analyze air samples and submit report.
- H. Volatile Organic Compounds Limits:
  - 1. Comply with CalGreen Building Standards Section 5.504.4.5, Table 504.4.4.5 "Formaldehyde Limits".
  - 2. Formaldehyde: Not more than 16 parts per billion.
  - 3. Comply with CalGreen Building Standards Section 5.504, Table 504.4.3 "VOC Content Limits for Architectural Coatings".
  - 4. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit" and Table 504.4.2 "Sealant VOC Limit".
  - 5. Total Volatile Organic Compounds (TVOCs): Not more than 200 micrograms per cubic meter.
  - 6. Chemicals Listed in CAL (CDPH SM) Table 4-1, other than Formaldehyde: Not more than allowable concentrations listed in Table 4-1.
  - 7. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
  - 8. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.
- I. Air Contaminant Concentration Test Methods:
  - 1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6A.
  - 2. Particulates: EPA 600/4-90/010 Method IP-10.
  - 3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
  - 4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.

- 5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.
- J. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

#### **3.04 VENTILATION EFFECTIVENESS TESTING**

- A. Perform ventilation effectiveness testing during commissioning period.
- B. Do not begin ventilation effectiveness testing until:
  - 1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
  - 2. Building flush-out or air contaminant testing has been completed satisfactorily.
  - 3. New HVAC filtration media have been installed.
- C. Test each air handler zone in accordance with ASHRAE Std 129.
- D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to Owner.

#### **END OF SECTION**

## **SECTION 01 60 00 PRODUCT REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. General product requirements.
  - 1. System Completeness.
  - 2. Installation of Products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Identification of Owner-supplied products.
- B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 40 00 - Quality Requirements: Product quality monitoring.
- D. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.
- F. Divisions 31 - 33: Sitework.

#### **1.03 REFERENCE STANDARDS**

- A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content.
- B. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute.
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.
- D. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products.
- E. GreenScreen (LIST) - GreenScreen for Safer Chemicals List Translator; Clean Production Action.
- F. GreenScreen (METH) - GreenScreen for Safer Chemicals Method v1.2; Clean Production Action.
- G. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.

- H. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework.
- I. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
- J. ISO 21930 - Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.
- K. NFPA 70 - National Electrical Code.
  - 1. Use California Electrical Code.

#### **1.04 SUBMITTALS**

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
  - 1. Submit within 15 days after date of Agreement.
  - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

#### **1.05 QUALITY ASSURANCE**

- A. CAL (CDPH SM) v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.
  - 1. Good: Product-specific; compliant with ISO 14044.
  - 2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
  - 3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
  - 4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.
  - 5. Good: GreenScreen (LIST) evaluation to identify Benchmark 1 hazards; a Health Product Declaration includes this information.
  - 6. Better: GreenScreen Full Assessment.

7. Best: GreenScreen Full Assessment by GreenScreen Licensed Profiler.
8. Acceptable Evidence: GreenScreen report.
9. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.
10. Previously used, reused, refurbished, and salvaged products are not considered recycled.
11. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
12. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of materials in the item.
13. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
14. Acceptable Evidence:
  - a. For percentage of recycled content, information from manufacturer.
  - b. For cost, Contractor's cost data.
15. Wood fabricated from timber abandoned in transit after harvesting is considered reused, not recycled.
16. Acceptable Evidence: Information about the origin or source, from Contractor or supplier.
17. In every case, indicate the location of final assembly.
18. For harvested products, indicate location of harvest.
19. For extracted (i.e. mined) products, indicate location of extraction.
20. For recovered products, indicate location of recovery.
21. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
22. Acceptable Evidence:
  - a. Manufacturer's certification.
  - b. Life cycle analysis (LCA) performed by third-party.
23. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit <http://www.fsccanada.org>, for the USA visit <http://www.fscus.org>.
24. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Drawings and Specifications:
  1. If a conflict exists between the Drawings and the Specifications (Project Manual), then the Contractor is to submit a Request for Interpretation from the Architect.



- a. As noted in the General Conditions, the more stringent requirements govern, including cost of materials and/or installation.
2. If a specific product is indicated on the Drawings for use, then that product is to be used without exception in the location identified.
3. If the Contractor proposes the use of another product other than the item indicated, whether or not listed in these specifications, Contractor is to submit the product using the complete substitution process. See the the Article titled "SUBSTITUTIONS".
4. AHJ (City Building Department) approval is also required prior to the use or installation of any substitution, on any product or location of product (requiring a revision to the Drawings or Specifications), included in these construction documents.
  - a. Installation of a non-approved product may result in the Contractor removing and replacing the non-approved product at the Contractor's own expense.
- B. General: Items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock, and include materials, equipment, assemblies, fabrications and systems.
  1. Named Products: Items identified by manufacturer's product name, including make or model designations indicated in the manufacturer's published product data.
  2. Materials: Products that are shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed or installed to form a part of the Work.
  3. Equipment: A product with operating parts, whether motorized or manually operated, that requires connections such as wiring or piping.
- C. Specific Product Requirements: Refer to requirements of Section 01 40 00 - Quality Requirements and individual product technical Sections for specific requirements for products.
- D. Minimum Requirements: Specified requirements for products are minimum requirements. Refer to general requirements for quality of the Work specified in Section 01 40 00 - Quality Requirements and elsewhere herein.
- E. Standard Products:
  1. Where specific products are not specified, provide standard products of types and kinds that are suitable for the intended purposes and that are usually and customarily used on similar projects under similar conditions.
  2. Products shall be as selected by Contractor and subject to review and acceptance by the Owner and Architect.
- F. Product Completeness:
  1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
  2. Comply with additional requirements specified herein in Article titled "SYSTEM COMPLETENESS".
- G. Code Compliance:
  1. All products, other than commodity products prescribed by Code, are to have a current ICC Evaluation Service Research Report (ICC ESR), CABO National Evaluation Report (NER), or other testing agencies as accepted by the City Building Department.

2. Refer to additional requirements specified in Section 01 41 00 - Regulatory Requirements.
- H. Fire Suppression, Mechanical, and Plumbing: Comply with requirements specified in Divisions 21, 22, and 23, as included in this Project Manual and in the Drawings.
- I. Electrical, Communications, and Electronic Safety and Security: Comply with requirements specified in Divisions 26, 27, and 28, as included in this Project Manual and in the Drawings.

## **2.02 SYSTEM COMPLETENESS**

- A. The Contract Drawings and Specifications are not intended to be comprehensive directions on how to produce the Work. Rather, the Drawings and Specifications are instruments of service prepared to describe the design intent for the completed Work.
- B. It is intended that all equipment, systems and assemblies be complete and fully functional even though not fully described. Provide all products and operations necessary to achieve the design intent described in the Contract Documents.
- C. Refer to related general requirements specified in Section 01 41 00 - Regulatory Requirements regarding compliance with minimum requirements of applicable codes, ordinances and standards.
- D. Omissions and Misdescriptions: Contractor shall report to Architect immediately when elements essential to proper execution of the Work are discovered to be missing or misdescribed in the Drawings and Specifications or if the design intent is unclear.
  1. Should an essential element be discovered as missing or misdescribed prior to receipt of Bids, an Addendum will be issued so that all costs may be accounted for in the Contract Sum.
  2. Should an obvious omission or misdescription of a necessary element be discovered and reported after execution of the Agreement, Contractor shall provide the element as though fully and correctly described, and a no-cost Change Order shall be executed.
  3. Refer to related General Requirements specified in Section 01 30 00 - Administrative Requirements and 01 31 14 - Facility Services Coordination regarding construction interfacing and coordination.

## **2.03 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
  1. Provide products that fully comply with the Contract Documents, are undamaged and unused at installation.
  2. Comply with additional requirements specified herein in Article titled "PRODUCT OPTIONS".
- B. See Section 01 40 00 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:
  1. Made outside the United States, its territories, Canada, or Mexico.
  2. Containing lead, cadmium, or asbestos.
- D. Where other criteria are met, Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 01 61 16.
  2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
  3. Are extracted, harvested, and/or manufactured closer to the location of the project.
  4. Have longer documented life span under normal use.
  5. Result in less construction waste. See Section 01 74 19
- E. Provide interchangeable components of the same manufacture for components being replaced.
1. To the fullest extent possible, provide products of the same kind from a single source. Products required to be supplied in quantity shall be the same product and interchangeable throughout the Work.
  2. When options are specified for the selection of any of two or more products, provide product selected to be compatible with products previously selected.
- F. Product Nameplates and Instructions:
1. Except for required Code-compliance labels and operating and safety instructions, locate nameplates on inconspicuous, accessible surfaces. Do not attach manufacturer's identifying nameplates or trademarks on surfaces exposed to view in occupied spaces or to the exterior.
  2. Provide a permanent nameplate on each item of service-connected or power-operated equipment. Nameplates shall contain identifying information and essential operating data such as the following example:
    - a. Name of manufacturer
    - b. Name of product
    - c. Model and serial number
    - d. Capacity
    - e. Operating and Power Characteristics
    - f. Labels of Tested Compliance with Codes and Standards
  3. Refer to additional requirements which may be specified in various sections, as included in this Project Manual.
  4. For each item of service-connected or power-operated equipment, provide operating and safety instructions, permanently affixed and of durable construction, with legible machine lettering. Comply with all applicable requirements of authorities having jurisdiction and listing agencies.
- G. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to CEC/NFPA 70, include lugs for terminal box.
- H. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

## 2.04 PRODUCT OPTIONS

- A. Unless the specifications state that no substitution is permitted, whenever the Contract Documents indicate any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction or any specific name, make, trade name, or catalog number, with or without the words "or equal," such specification shall be deemed to be used for the purpose of facilitating description of the material, process, or article desired and shall be deemed to be followed by the words "or equal."
  - 1. See Section 01 25 00 - Substitution Procedures.
- B. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
  - 1. Reference Standards:
    - a. Where Specifications require compliance with a standard, provided product shall fully comply with the standard specified.
    - b. Refer to general requirements specified in Section 01 42 19 - Reference Standards regarding compliance with referenced standards, standard specifications, codes, practices and requirements for products.
  - 2. Product Description:
    - a. Where Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that has the specified attributes and otherwise complies with specified requirements.
  - 3. Performance Requirements:
    - a. Where Specifications require compliance with performance requirements, provide product(s) that comply and are recommended by the manufacturer for the intended application.
    - b. Verification of manufacturer's recommendations may be by product literature or by certification of performance from manufacturer.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Products Specified by Identification of Manufacturer and Product Name or Number:
  - 1. "Specified Manufacturer": Provide the specified product(s) of the specified manufacturer.
    - a. If only one manufacturer is specified, without "acceptable manufacturers" being identified, provide only the specified product(s) of the specified manufacturer.
    - b. If Owner standard is indicated make all efforts to provide that product.
    - c. If the phrase "or equal" or "approved equal" is stated or reference is made to the "or equal provision," products of other manufacturers may be provided if such products are equivalent to the specified product(s) of the specified manufacturer.
      - 1) Equivalence shall be demonstrated by submission of information in compliance with requirements of Section 01 25 00 - Substitution Procedures.
  - 2. "Acceptable Manufacturers":

- a. Product(s) of the named manufacturers, if equivalent to the specified product(s) of the specified manufacturer, will be acceptable in accordance with the requirements of Section 01 25 00 - Substitution Procedures.
    - 1) Exception: Considerations regarding changes in Contract Time and Contract Sum will be waived if no increase in Contract Time or Contract Sum results from use of such equivalent products.
- 3. Unnamed manufacturers: Product(s) of unnamed manufacturers will be acceptable when disclosed during the bidding period and only as follows:
  - a. Unless specifically stated that substitutions will not be accepted or considered, the phrase "or equal" shall be assumed to be included in the description of specified product(s).
  - b. Equivalent products of unnamed manufacturers will be accepted in accordance with the "or equal" provision specified herein, below.
  - c. If provided, products of unnamed manufacturers shall be subject to the requirements of Section 01 25 00 - Substitution Procedures.
- 4. Quality basis:
  - a. Specified product(s) of the specified manufacturer shall serve as the basis by which products by named acceptable manufacturers and products of unnamed manufacturers will be evaluated.
  - b. Where characteristics of the specified product are described, where performance characteristics are identified or where reference is made to industry standards, such characteristics are specified to identify the most significant attributes of the specified product(s) which will be used to evaluate products of other manufacturers.
- E. Products Specified by Combination of Methods: Where products are specified by a combination of attributes, including manufacturer's name, product brand name, product catalog or identification number, industry reference standard, or description of product characteristics, provide products conforming to all specified attributes.
- F. "Or Equal" Provision: Where the phrase "or equal" or the phrase "or approved equal" is included, equivalent product(s) of unnamed manufacturer(s) may be provided as specified above in subparagraph titled "Unnamed manufacturers" and Section 01 25 00 - Substitution Procedures with the following conditions:
  - 1. The requirements of Section 01 25 00 - Substitution Procedures applies to products provided under the "or equal" provision.
    - a. Exception: If the proposed product(s) are determined to be equivalent to the specified product(s) of the specified manufacturer, the requirement specified for substitutions to result in a net reduction in Contract Time or Contract Sum will be waived.
  - 2. Use of product(s) under the "or equal" provision shall not result in any delay in completion of the Work, including completion of portions of the Work for use by Owner or for work under separate contract by Owner.
  - 3. Use of product(s) under the "or equal" provision shall not result in any costs to the Owner, including design fees and permit and plan check fees.

4. Use of product(s) under the "or equal" provision shall not require substantial change in the intent of the design, in the opinion of the Architect.
    - a. The intent of the design shall include functional performance and aesthetic qualities.
  5. The determination of equivalence will be made by the Architect and Owner, and such determination shall be final.
- G. Visual Matching:
1. Where Specifications require matching a sample, the decision by the Architect on whether a proposed product matches shall be final.
  2. Where no product visually matches but the product complies with other requirements, comply with provisions for substitutions for selection of a matching product in another category.
- H. Visual Selection of Products:
1. Where requirements include the phrase "as selected from manufacturer's standard colors, patterns and textures", or a similar phrase, selections of products will be made by indicated party or, if not indicated, by the Architect. The will select color, pattern and texture from the product line of submitted manufacturer, if all other specified provisions are met.
  2. The Architect will select color, pattern and texture from the product line of submitted manufacturer, if all other specified provisions are met.

## **2.05 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 01 25 00 - Substitution Procedures.

### **3.02 OWNER-SUPPLIED PRODUCTS**

- A. See Section 01 10 00 - Summary for identification of Owner-supplied products.
- B. Owner's Responsibilities:
  1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  2. Arrange and pay for product delivery to site.
  3. On delivery, inspect products jointly with Contractor.
  4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

### **3.03 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
  1. Schedule delivery to minimize long-term storage and prevent overcrowding construction spaces.
  2. Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport products by methods to avoid product damage.
- F. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- G. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- H. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- I. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.04 STORAGE AND PROTECTION**

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
  1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Inspection Provisions: Arrange storage to provide access for inspection and measurement of quantity or counting of units.
- D. Structural Considerations: Store heavy materials away from the structure in a manner that will not endanger supporting construction.
- E. Store and protect products in accordance with manufacturers' instructions.

- F. Store with seals and labels intact and legible.
- G. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- H. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- I. For exterior storage of fabricated products, place on sloped supports above ground.
  - 1. Place products on raised blocks, pallets or other supports, above ground and in a manner to not create ponding or misdirection of runoff.
- J. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- K. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
  - 1. Periodically inspect to ensure products are undamaged, and are maintained under required conditions.
  - 2. Remove and replace products damaged by improper storage or protection with new products at no change in Contract Sum or Contract Time.
  - 3. Weather-Resistant Storage:
    - a. Store moisture-sensitive products above ground, under cover in a weathertight enclosure or covered with an impervious sheet covering. Provide adequate ventilation to avoid condensation.
    - b. Maintain storage within temperature and humidity ranges required by manufacturer's instructions.
    - c. Store loose granular materials on solid surfaces in a well-drained area. Prevent mixing with foreign matter.
- L. Comply with manufacturer's warranty conditions, if any.
- M. Do not store products directly on the ground.
- N. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- O. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- P. Prevent contact with material that may cause corrosion, discoloration, or staining.
- Q. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- R. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

### **3.05 INSTALLATION OF PRODUCTS**

- A. Comply with manufacturer's instructions and recommendations for installation of products, except where more stringent requirements are specified, are necessary due to Project conditions or are required by authorities having jurisdiction.



- B. Anchor each product securely in place, accurately located and aligned with other Work.
- C. Clean exposed surfaces and provide protection to ensure freedom from damage and deterioration at time of Substantial Completion review. Refer to additional requirements specified in General Conditions, Section 01 50 00 - Temporary Construction Facilities and Controls and 01 70 00 - Execution and Closeout Requirements.

### **3.06 PROTECTION OF COMPLETED WORK**

- A. Provide barriers, substantial coverings and notices to protect installed Work from traffic and subsequent construction operations.
- B. Remove protective measures when no longer required and prior to Substantial Completion review of the Work.
- C. Comply with additional requirements specified in Section 01 50 00 - Temporary Construction Facilities and Controls.

**END OF SECTION**

**SECTION 01 61 16**  
**VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 40 00 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01 60 00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 07 92 00 - Joint Sealants: Emissions-compliant sealants.

**1.03 DEFINITIONS**

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
  - 3. Flooring.
  - 4. Composite wood.
  - 5. Products making up wall and ceiling assemblies.
  - 6. Thermal and acoustical insulation.
  - 7. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Exterior and interior paints and coatings.
  - 2. Exterior and interior adhesives and sealants, including flooring adhesives.
  - 3. Wet-applied roofing and waterproofing.
  - 4. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
1. Concrete.
  2. Clay brick.
  3. Metals that are plated, anodized, or powder-coated.
  4. Glass.
  5. Ceramics.
  6. Solid wood flooring that is unfinished and untreated.

#### **1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.
- D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- F. CHPS (HPPD) - High Performance Products Database.
- G. CRI (GL) - Green Label Testing Program - Certified Products.
- H. CRI (GLP) - Green Label Plus Testing Program - Certified Products.
- I. GreenSeal GS-36 - Standard for Adhesives for Commercial Use.
- J. SCAQMD 1113 - Architectural Coatings.
- K. SCAQMD 1168 - Adhesive and Sealant Applications.
- L. SCS (CPD) - SCS Certified Products.
- M. UL (GGG) - GREENGUARD Gold Certified Products.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.
  1. Use the form following this section for installer certifications.

- D. Verification of compliance with VOC limits as specified in the CalGreen Code Section 5.504 shall be provided at the request of the Building Inspector.
  - 1. Product certification and specifications.
  - 2. Chain of custody certifications.
  - 3. Product, labeled and invoiced as meeting the Composite Wood Products regulation.
  - 4. Exterior grade products marked as meeting the PS-1 or PS-2 standards of the Engineered Wood Association, the Australian AS/NZS 2269 or European 636 3S standards
  - 5. Other methods approved by the building official.
- E.

#### **1.06 QUALITY ASSURANCE**

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
  - 1. Wet-Applied Products: State amount applied in mass per surface area.
  - 2. Paints and Coatings: Test tinted products, not just tinting bases.
  - 3. Evidence of Compliance: Acceptable types of evidence are the following;
    - a. Current UL (GGG) certification.
    - b. Current SCS (CPD) Floorscore certification.
    - c. Current SCS (CPD) Indoor Advantage Gold certification.
    - d. Current listing in CHPS (HPPD) as a low-emitting product.
    - e. Current CRI (GLP) certification.
    - f. Test report showing compliance and stating exposure scenario used.
  - 4. Product data submittal showing VOC content is NOT acceptable evidence.
  - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
  - 1. Evidence of Compliance: Acceptable types of evidence are:
    - a. Report of laboratory testing performed in accordance with requirements.
    - b. Published product data showing compliance with requirements.
    - c. Certification by manufacturer that product complies with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
  - 1. Evidence of Compliance: Acceptable types of evidence are:
    - a. Current SCS "No Added Formaldehyde (NAF)" certification; [www.scs-certified.com](http://www.scs-certified.com).
    - b. Report of laboratory testing performed in accordance with requirements.
    - c. Published product data showing compliance with requirements.
    - d. Certification by manufacturer that product complies with requirements.

- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. All VOC restricted products shall be compliant with local jurisdiction, South Coast Air Quality Management District, and California Green Standards Code, Rules and Regulations in effect at the time of installation. Products specified in this project shall be used as a basis of design. Updated products that are compliant with the rules in force at the time of installation shall be submitted as substitutions when they become available.
  - 1. If a product is found to be non-compliant with the VOC rules at the scheduled time of installation, notify the Architect a minimum of 90 days prior to installation. Contractor shall submit a suggested compliant product that is equal to the performance and cost of the specified product using the substitution procedure.

### **2.02 MATERIALS**

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
  - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
    - a. Comply with CalGreen Building Standards Section 5.504.4.5, Table 504.4.4.5 "Formaldehyde Limits".
  - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
  - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
  - 2. Aerosol Adhesives: GreenSeal GS-36.
  - 3. Joint Sealants: SCAQMD 1168 Rule.
  - 4. Paints and Coatings: Each color; most stringent of the following:
    - a. 40 CFR 59, Subpart D.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
    - d. CalGreen Building Standards Section 5.504, Table 504.4.3 "VOC Content Limits for Architectural Coatings".
    - e. Clear Wood Finishes, Floor Coatings, Stains, Primers and Shellacs: Do not exceed the VOC content limits established in SCAQMD 1113 rule.
  - 5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

6. Carpet, Carpet Tile, and Adhesive: Provide products having VOC content not greater than that required for CRI (GLP) certification.
  - a. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit".
7. Carpet Cushion: Provide products having VOC content not greater than that required for CRI (GL) certification.
  - a. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit".
- D. Other Product Categories: Comply with limitations specified elsewhere.

### **PART 3 EXECUTION**

#### **3.01 FIELD QUALITY CONTROL**

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

**END OF SECTION**

**SECTION 01 61 16.01**  
**ACCESSORY MATERIAL VOC CONTENT CERTIFICATION FORM**

**FORM**

**1.01 IDENTIFICATION:**

- A. Project Name: Big Bear Administrative Facility
- B. Project No.: 5-08-03
- C. Architect: Ruhnau Clarke Architects

**1.02 USE OF THIS FORM:**

- A. Because installers are allowed and directed to choose accessory materials suitable for the applicable installation, there is a possibility that such accessory materials might contain VOC content in excess of that permitted, especially where such materials have not been explicitly specified.
  - 1. Each installer of work on this project is required to certify that his/their use of these particular materials complies with the contract documents and to provide documentation showing that the products used do not contain the prohibited content.
- B. Contractor is required to obtain and submit this form from each installer of work on this project.
- C. For each product category listed, check the correct paragraph.
- D. If any of these accessory materials has been used, attach to this form product data and MSDS sheet for each such product.

**1.03 VOC CONTENT RESTRICTIONS ARE SPECIFIED IN SECTION 01 61 16.**

- A. Volatile organic compounds (VOCs) are defined by the U.S. EPA, California Air Resources Board (CARB), South Coast Air Quality Management District (SCAQMD), along with other state and local regulations applicable to this project.

**2.01 PRODUCT CERTIFICATION**

- A. I certify that the installation work of my firm on this project:
  - 1. [HAS] [HAS NOT] required the use of any ADHESIVES.
  - 2. [HAS] [HAS NOT] required the use of any JOINT SEALANTS.
  - 3. [HAS] [HAS NOT] required the use of any PAINTS OR COATINGS.
  - 4. [HAS] [HAS NOT] required the use of any COMPOSITE WOOD or AGRIFIBER PRODUCTS.
- B. Product data and MSDS sheets are attached.

**3.01 CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)**

- A. Firm Name: \_\_\_\_\_
- B. Print Name: \_\_\_\_\_
- C. Signature: \_\_\_\_\_
- D. Title: \_\_\_\_\_ (officer of company)
- E. Date: \_\_\_\_\_

**END OF SECTION**



**SECTION 01 70 00**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures.
- C. Section 01 31 14 - Facility Services Coordination: Coordination of trades.
- D. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- E. Section 01 45 33 - Code-Required Special Inspections: Construction oversight procedures by City Building Department regarding the execution, approval, and closeout of this building project.
- F. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- G. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.
- H. Section 01 71 23 - Field Engineering: Additional requirements for field engineering and surveying work.
- I. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- J. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- K. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

- L. Section 01 91 13 - General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.
- M. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- N. Section 07 84 00 - Firestopping.
- O. Individual Product Specification Sections:
  - 1. Advance notification to other sections of openings required in work of those sections.
  - 2. Limitations on cutting structural members.

### **1.03 REFERENCE STANDARDS**

- A. CBC Ch. 11B - California Building Code-Chapter 11B.
- B. CFC Ch. 33 - Fire Safety During Construction and Demolition.
- C. CFC Ch. 35 - California Fire Code - Chapter 35 - Welding and Other Hot Work.
- D. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
  - 6. Include in request:
    - a. Identification of Project.
    - b. Location and description of affected work. Include shop drawings as necessary to identify locations and communicate descriptions.
    - c. Necessity for cutting or alteration.
    - d. Description of proposed work and products to be used.
    - e. Effect on work of Owner or separate Contractor.
    - f. Effect on existing construction of Owner and, if applicable, work for Project being provided by Owner under separate contract.
    - g. Written permission of affected separate Contractor.

- h. Date and time work will be executed.
- 7. Include written evidence that those performing work under separate contract for Owner have been notified and acknowledge that cutting and patching work will be occurring. Include written permission for intended cutting and patching, included scheduled times.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

#### **1.05 QUALIFICATIONS**

- A. For demolition work, employ a firm specializing in the type of work required.
  - 1. Minimum of 5 years of documented experience.
- B. For surveying work, employ a land surveyor registered in California and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in California. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
- D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in California.

#### **1.06 PROJECT CONDITIONS**

- A. Protect site from puddling or running water.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
  - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
- C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Minimize amount of bare soil exposed at one time.
  - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
  - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
  - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
  - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers, pneumatic hammers, air-operated nail guns, and diesel engines.
  - 2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

- F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

## **1.07 COORDINATION**

- A. See Section 01 10 00 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## **PART 2 PRODUCTS**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.

- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.
- D. Temporary Supports: Provide supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- E. Weather Protection: Provide protection from elements for areas which may be exposed by uncovering Work. Maintain excavations free of water.

### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
  - 1. Coordinate operations of the various trades to assure efficient and orderly installation of each part of Work.
  - 2. Coordinate Work operations of the various trades that depend on each other for proper installation, connection, and operation of Work, including but not limited to:
    - a. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.
    - b. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
    - c. Provide provisions to accommodate items scheduled for later installation.
  - 3. Prepare and administer coordination drawings. Refer to Section 01 31 14 - Facility Services Coordination.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 LAYING OUT THE WORK**

- A. Notify the Owner at least 48 hours before staking is to be started.
- B. Verify locations of survey control points prior to starting work.
- C. Promptly notify Architect of any discrepancies discovered.
- D. Contractor shall locate and protect survey control and reference points.
- E. Control datum for survey is that established by Owner provided survey.
- F. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- G. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- H. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- I. Utilize recognized engineering survey practices.
- J. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- K. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
  - 4. Controlling lines and levels required for mechanical and electrical trades.
- L. Periodically verify layouts by same means.
- M. Maintain a complete and accurate log of control and survey work as it progresses.
- N. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

### **3.05 GENERAL INSTALLATION REQUIREMENTS**

- A. Dimensions for Accessibility:
  - 1. Conventions: See CBC Ch. 11B Figure 11B-104. Dimensions that are not stated as "maximum" or "minimum" are absolute.
  - 2. Tolerances shall be per CBC Ch. 11B-104.1.1 "Construction and manufacturing tolerances. All dimensions are subject to conventional industry tolerances except where the requirement is stated as a range with specific minimum and maximum end points."
- B. In addition to compliance with regulatory requirements, conduct construction operations in compliance with ASTM F477 and NFPA 241, including applicable recommendations in Appendix A.
- C. When welding or doing other hot work, comply with CFC Ch. 35.
- D. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

- E. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- F. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- G. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- H. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.06 ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
  - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
  - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
  - 2. Remove items indicated on drawings.
  - 3. Relocate items indicated on drawings.
  - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
  - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
  3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
  4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

### **3.07 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
  2. Fit products together to integrate with other work.
  3. Provide openings for penetration of mechanical, electrical, and other services.
  4. Match work that has been cut to adjacent work.
  5. Repair areas adjacent to cuts to required condition.
  6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
1. Coordinate installation or application of products for integrated Work.
  2. Uncover completed Work as necessary to install or apply products out of sequence.
  3. Remove and replace defective or non-conforming Work.



- 4. Provide openings for penetration of utility services, such as plumbing, mechanical and electrical Work.
- E. After uncovering existing Work, inspect conditions affecting proper accomplishment of Work.
- F. Temporary Supports: Provide supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- G. Beginning of cutting or patching shall be interpreted to mean that existing conditions were found by Contractor to be acceptable.
- H. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- I. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
  - 1. Use a diamond grit abrasive saw or similar cutter for smooth edges. Do not overcut corners.
- J. Restore work with new products in accordance with requirements of Contract Documents.
- K. Fit work neat and tight allowing for expansion and contraction.
- L. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- M. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- N. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- O. Finishing: Refinish surfaces to match adjacent and similar finishes as used for the Project.
  - 1. For continuous surfaces, refinish to nearest intersection or natural break.
  - 2. For an assembly, refinish entire unit.

### **3.08 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

### **3.09 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.10 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.11 PROJECT CLOSEOUT CONFERENCE**

- A. Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Completion.
  - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Authorized representatives of Owner, Commissioning Authority (CxA), Architect, and relevant consultants; Contractor and project superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
  - a. Preparation of record documents.
  - b. Commissioning.
  - c. Procedures required prior to inspection for Completion and for final inspection for acceptance.
  - d. Submittal of written warranties.
  - e. Coordination of separate contracts.
  - f. Owner's partial occupancy requirements.
  - g. Installation of Owner's furniture, fixtures, and equipment.
  - h. Responsibility for removing temporary facilities and controls.
4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.12 COMMISSIONING OF PROJECT**

#### **A. Project Completion**

1. Prior to notifying the Architect that the project is complete according to the construction and contract documents, the Contractor shall submit to the Architect:
  - a. Approved pre-functional checklists and functional performance testing reports from the commissioning documentation.

#### **B. Final Acceptance**

1. Prior to requesting inspection for verification of completion of all outstanding items, the Contractor shall submit to the Architect:
  - a. The commissioning requirements of Section 01 91 13 - General Commissioning Requirements must be complete prior to final acceptance, unless approved in writing by the Owner. Exceptions to this are any required seasonal or approved deferred testing.

### **3.13 DEMONSTRATION AND INSTRUCTION**

- A. See Section 01 79 00 - Demonstration and Training.

### **3.14 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Division 23 - HVAC.

### **3.15 FINAL CLEANING**

- A. Cleaning and Disposal Requirements, General: Conduct cleaning and disposal operations in compliance with all applicable codes, ordinances and regulations, including environmental protection laws, rules and practices.
- B. Execute final cleaning prior to final project assessment.
  - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- C. Final Inspection Review Cleaning, General: Execute a thorough cleaning prior to Completion review by Architect and Owner. Employ experienced workers or professional cleaners for cleaning operations for final inspection review.
- D. Use cleaning materials that are nonhazardous.
  - 1. Cleaning Agents and Materials: Use only those cleaning agents and materials which will not create hazards to health or property and which will not damage or degrade surfaces.
    - a. Use only those cleaning agents, materials and methods recommended by manufacturer of the material to be cleaned.
    - b. Use cleaning materials only on surfaces recommended by cleaning agent manufacturer.
    - c. Before use, review cleaning agents and materials with Owner Representative for suitability and compatibility. Use no cleaning agents and materials without approval as noted above.
  - 2. Cleaning Procedures: All cleaning processes, agents and materials shall be subject to Architect, Owner and/or Owner Representative review and approval. Processes and degree of cleanliness shall be as directed by Architect, Owner and/or Owner Representative.
- E. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- G. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- H. Clean filters of operating equipment.
- I. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- J. Clean site; sweep paved areas, rake clean landscaped surfaces.
- K. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.16 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to Architect and Owner.

- B. Accompany Owner, Architect, and Owner Representative on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's comprehensive list of items to be completed or corrected.
  - 1. As authorized by the Owner; Architect and Architect's and Owner's consultants, as appropriate, will attend a meeting at the Project site to review Contract closeout procedures and to review the list of items to be completed and corrected (punch list) to make the Work ready for acceptance by the Owner.
  - 2. This meeting shall be scheduled not earlier than 14 days prior to the date anticipated for the Final Inspection review.
- C. Notify Architect when work is considered ready for Architect's Final inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Final inspection.
  - 1. Final Application for Payment: In the Application for Payment that coincides with the date Final Inspection/Completion is claimed, show 100 percent completion for the portion of the Work claimed substantially complete.
  - 2. Warranties, Bonds and Certificates: Submit specific warranties, guarantees, workmanship bonds, maintenance agreements, final certifications and similar documents.
  - 3. Locks and Keys: Change temporary lock cylinders over to permanent keying and transmit keys to the Owner, unless otherwise directed or specified.
  - 4. Tests and Instructions: Complete start-up testing of systems, and instruction of the Owner's personnel. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- E. Clearing and Cleaning: Prior to the Final Inspection review, Contractor shall conduct a thorough cleaning and clearing of the Project area, including removal of construction facilities and temporary controls.
- F. Inspection and Testing: Prior to the Final Inspection review, complete inspection and testing required for the Work, including securing of approvals by authorities having jurisdiction.
  - 1. Complete all inspections, tests, balancing, sterilization and cleaning of plumbing and HVAC systems.
  - 2. Complete inspections and tests of electrical power and signal systems.
  - 3. Complete inspections and tests of conveying (elevator or wheelchair lift) systems.
- G. Owner will occupy all of the building as specified in Section 01 10 00.
- H. Conduct Final Inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
  - 1. Correction (Punch) List: Contractor shall prepare and distribute at the preliminary Contract closeout review meeting, a typewritten, comprehensive list of items to be completed and corrected (punch list) to make the Work ready for acceptance by the Owner.

- a. The punch list shall include all items to be completed or corrected prior to the Contractor's application for final payment.
  - b. The punch list shall identify items by location (room number or name) and consecutive number. For example, 307-5 would identify item 5 in Room 307, Roof-4 would identify item 4 on Roof.
  - c. Contractor shall prepare separate lists according to categories used for Drawings. For example, provide lists for Architectural, Structural, Plumbing, Mechanical, Electrical, Fire Protection, Civil, and Landscape.
  - d. Architect, Architect's consultants and Owner's consultants, if in attendance, will conduct a brief walk-through of Project with the Contractor to review scope and adequacy of the punch list.
  - e. Verbal comments will be made to the Contractor by the AHJ, the Architect and the Architect's and Owner's consultants, if in attendance, during the walk-through. These comments will indicate generally the additions and corrections to be made to the punch list. Such comments shall not be considered to be comprehensive; Contractor shall use the comments as guidance in preparing the punch list for the Final Inspection review.
2. Final Inspection Meeting: On a date mutually agreed by the Owner, Architect, and Contractor, a meeting shall be conducted at the Project site to determine whether the Work is satisfactory and complete for filing a Notice of Completion.
- a. Contractor shall provide three working days notice to Architect for requested date of Final Inspection meeting.
  - b. The Owner Representative, the Architect with Architect's / Owner's consultants, as authorized by the Owner, will attend the Final Inspection meeting.
  - c. In addition to conducting a walk-through of the facility and reviewing the punch list, the purpose of the meeting shall include submission of warranties, guarantees and bonds to the Owner, submission of operation and maintenance data (manuals), provision of specified extra materials to the Owner, and submission of other Contract closeout documents and materials as required and if not already submitted.
  - d. The Owner Representative, Architect and Architect's consultants, as appropriate, will conduct a walk-through of the facility with the Contractor and review the punch list.
  - e. Contractor shall correct the punch list and record additional items as may identified during the walk-through, including notations of corrective actions to be taken.
  - f. Contractor shall retype the punch list and distribute it within three working days to those attending the meeting.
  - g. If additional site visits by the Owner Representative, the Architect and the Architect's and Owner's consultants are required to review completion and correction of the Work, the costs of additional visits shall be reimbursed to the Owner by the Contractor by deducting such costs from the Final Payment.
- I. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

- J. Notify Architect when work is considered finally complete and ready for Architect's Final Inspection.
  - 1. Architect's Certification of Completion:
    - a. When Architect determines that list of items to be completed and corrected (Punch List) is sufficiently complete for Owner to occupy Project for the use to which it is intended.
- K. Complete items of work determined by Architect listed in executed Certificate of Completion.

### **3.17 FINAL PAYMENT**

- A. After completion of all items listed for completion and correction, after submission of all documents and products and after final cleaning, submit final Application for Payment, identifying total adjusted Contract Sum, previous payments and sum remaining due.
- B. Payment will not be made until the following are accomplished:
  - 1. All Project Record Documents have been transferred and accepted by Owner.
  - 2. All extra materials and maintenance stock have been transferred and received by Owner.
  - 3. All warranty documents and operation and maintenance data have been received and accepted by Owner.
  - 4. All liens have been released or bonded by Contractor.
  - 5. Contractor's surety has consented to Final Payment.
  - 6. All documentation required by AHJ has been completed.

### **3.18 MAINTENANCE**

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Project Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

### **END OF SECTION**

**SECTION 01 71 23**  
**FIELD ENGINEERING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Field engineering services by Contractor.
- B. Land surveying services by Contractor.

**1.02 DESCRIPTION OF SERVICES**

- A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.
- B. Sole responsibility for establishing all locations, dimensions and levels of items of work.
- C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.
- D. Having a skilled instrument person(s) available on short notice when necessary for laying out the work.
- E. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.
- F. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
  - 1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.
- G. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
  - 1. Number of employees at the Site.
  - 2. Number employees at the Site for each of Contractor's subcontractors.
  - 3. Breakdown of employees by trades.
  - 4. Major equipment and materials installed as part of the work.
  - 5. Major construction equipment utilized.
  - 6. Location of areas in which construction was performed.
  - 7. Materials and equipment received.
  - 8. Work performed, including field quality control measures and testing.
  - 9. Weather conditions.
  - 10. Safety.
  - 11. Delays encountered, amount of delay incurred, and the reasons for the delay.



- 12. Instructions received from Architect or Owner, if any.
- H. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.
- I. Prior to backfilling operations, surveying - locating, and recording on a copy of Contract Documents - an accurate representation of buried work and Underground Facilities encountered.
- J. Setting up and executing time-lapse photography of construction activities.

### **1.03 REFERENCE STANDARDS**

- A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology.
- B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks.
- C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement.
- D. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems.
- E. State Plane Coordinate System for California.

### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Submit in addition to items required in Section 01 70 00 - Execution and Closeout Requirements.
- C. Informational Submittals: Submit the following:
  - 1. Field Engineering: Submit daily reports, with content as indicated in this section.
    - a. When requested by Architect, submit for Record documentation verifying accuracy of field engineering including, but not limited to, Contractor's survey notes and field notes.
  - 2. Final property survey.

### **1.06 QUALITY ASSURANCE**

- A. Field Engineer's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.
- B. Land Surveyor's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.
- C. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.
- D. Minimum accuracy for required work is as follows:

1. Grade: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
2. Culverts and ditches: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
3. Structures: Horizontal Tolerance: Plus or minus 0.5 feet (location), Vertical Tolerance: Plus or minus 0.05 feet.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Owner's Representative and Architect of any discrepancies immediately in writing before proceeding to lay out the work. Locate and protect existing benchmarks and base line. Preserve permanent reference points during construction.
- B. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

### **3.02 FIELD ENGINEERING**

- A. Maintain field office files, drawings, specifications, and record documents.
- B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.
- C. Prepare layout and coordination drawings for construction operations.
- D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.
- E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.
- F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.
- G. In general, match existing adjacent grades and maintain existing flow lines.
- H. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner's concurrence of the remediation plan.
- I. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with shop drawings and Contract Documents requirements.
- J. Check all bracing and shoring for structural integrity and compliance with designs prepared by the Contractor.

### **3.03 LAND SURVEYING**

- A. General: Follow standards for geospatial positioning accuracy.
  - 1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
  - 2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
  - 3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.
- B. Coordinate survey data with the State Plane Coordinate System of California.
- C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in California, and approved by the Architect.
  - 1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

### **3.04 CONSTRUCTION SURVEYING**

- A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
  - 1. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.
  - 2. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.
  - 3. Structure: Stake out structures, including elevations, and check prior to and during construction.
  - 4. Pipelines: Stake out pipelines including elevations, and check prior to and during construction.
  - 5. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
  - 6. Road: Stake out roadway elevations at 50 foot intervals on tangent, and at 25 foot intervals on curves.
  - 7. Cross-sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveys.
  - 8. Easement Staking: Provide easement staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. If required by project conditions, provide wooden laths with flagging at 100 foot intervals.
  - 9. Record Staking: Provide permanent stake at each blind flange and each utility cap is provided for future connections. Use stakes for record staking of material(s) acceptable to Architect.
  - 10. Structural Frame: Upon completion, certify location and plumbness.
- B. Surveying to Determine Quantities for Payment.

1. For each application for progress payment, perform such surveys and computations necessary to determine quantities of work performed or placed. Perform surveys necessary for Architect to determine final quantities of work in place.
  2. Notify Architect at least 24 hours before performing survey services for determining quantities. Unless waived in writing by Architect, perform quantity surveys in presence of Architect.
- C. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.
- D. Use by the Architect: The Architect may at any time use line and grade points and markers established by the Contractor. The Contractor's surveys are a part of the work and may be checked by the Architect at any time.
- E. Accuracy:
1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
    - a. Horizontal accuracy of easement staking: Plus or minus 0.1 feet.
    - b. Accuracy of other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.02 feet vertically.
    - c. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.
  2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

### **3.05 SUPPORT AND BRACING**

- A. General requirements: Design all support and bracing systems, if required. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure.
- B. Seismic Bracing: Design where required by authorities having jurisdiction.
1. Design and install all support systems to comply with the seismic requirements of the Construction Code of California.
  2. Design and install seismic bracing so as not to defeat the operation on any required vibration isolation or sound isolation devices.
  3. For seismic bracing guidelines for mechanical, electrical and plumbing systems, refer to SMACNA (SRM).

### **3.06 TIME-LAPSE PHOTOGRAPHY**

- A. Provide as part of Construction Progress documentation.
- B. Set a pole at appropriate location(s), and provide a time-lapse camera to record the entire construction project. Camera (or cameras) is required to provide a field of view of the entire project area.

- C. Provide a camera that records at one frame per second rate, or as approved by Architect. Resulting time-lapse will be viewed at standard 25 frames-per-second speed.
  - 1. Program camera, or provide a timer-controller, to only record during construction work hours.
- D. Submit to the Owner and Architect a DVD containing the raw video on a weekly basis. Submit entire digital time-lapse photography record at the conclusion of the project.

### **3.07 REPORTS**

- A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

### **3.08 RECORDS**

- A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
  - 1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in California. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
  - 2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.
- B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
  - 1. Structure locations from property lines, and distances to adjacent buildings.
  - 2. Dimensions and locations of drives, walks, walls, underground utilities, appurtenances, and major site features.
  - 3. Location of easements.
  - 4. Final grading topographic survey.

### **3.09 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

## **END OF SECTION**

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 GENERAL**

**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Comply with the requirements Section 5.408 of the California Green Building Standards Code.
  - 1. Recycle and/or salvage for reuse a minimum of 65percent of the nonhazardous construction and demolition waste in accordance with Section 504.8.1.1, 5.408.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.
- B. Owner requires that this project generate the least amount of trash and waste possible.
- C. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- D. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
  - 1. Aluminum and plastic beverage containers.
  - 2. Corrugated cardboard.
  - 3. Wood pallets.
  - 4. Clean dimensional wood.
  - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 - Site Clearing for use options.
    - a. Comply with California Green Code (CGC) 5.408.3; Excavated soil and land clearing debris: 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled.
      - 1) Exception: Reuse, either on-or off-site, of vegetation or soil contaminated by disease or pest infestation.
  - 6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
  - 7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
  - 8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
  - 9. Asphalt paving: May be recycled into paving for project.
  - 10. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
  - 11. Glass.

12. Gypsum drywall and plaster.
13. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (<http://flooring.dupont.com>) and Interface ([www.interfaceinc.com](http://www.interfaceinc.com)) conduct reclamation programs.
14. Roofing.
15. Paint.
16. Plastic sheeting.
17. Rigid foam insulation.
18. Windows, doors, and door hardware.
19. Plumbing fixtures.
20. Mechanical and electrical equipment.
21. Fluorescent lamps (light bulbs).
22. Acoustical ceiling tile and panels.
23. Materials which could be hazardous and subject to special disposal regulations include but are not limited to the following: CalGreen Section 5.408.2
  - a. Lead-Based Paint
  - b. Asbestos: Found in older pipe insulation, asphalt floor tiles, linoleum, insulation, etc.
  - c. Polychlorinated Biphenyls (PCBs):
    - 1) Found in electrical oil filled equipment manufactured prior to 1978 such as transformers, switches and fluorescent lamp ballasts.
    - 2) Also found in adhesive, sealant, caulk, glazing putty, roofing material, pesticide vehicle, ink, paper, fabric dye, gaskets, and hydraulic fluid.
  - d. HVAC Refrigerants: Containing Fluorinated and Chlorinated compounds.
  - e. Drinking Fountain Refrigerants: Containing Fluorinated and Chlorinated compounds.
  - f. Fluorescent Light Tubes: Contain mercury.
  - g. EXIT signs and Smoke Detectors: May contain unregulated, radioactive tritium. Required to be returned to manufacturer.
  - h. Contaminated Soils.
  - i. Pressure Treated Lumber.
- F. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
  1. Contractor's quantitative reports for construction waste materials as a condition of approval of progress payments.
- G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements. CalGreen Section 5.408.1.1.
- H. The following sources may be useful in developing the Waste Management Plan:
  1. California Recycling Department, at [www.bsc.ca.gov/Home/CALGreen.aspx](http://www.bsc.ca.gov/Home/CALGreen.aspx).
  2. General information contacts regarding construction and demolition waste:

- a. EPA Construction and demolition (C&D) debris website:  
[www.epa.gov/epawaste/conserve/imr/cdm/](http://www.epa.gov/epawaste/conserve/imr/cdm/).
  - b. Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies: [www.fpl.fs.fed.us/documnts/fplgtr/fpl\\_gtr150.pdf](http://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf).
  - c. Additional resources to be developed by Contractor with assistance from Owner and **Contractor, as requested.**
3. Recycling Haulers and Markets: The source list below contains local haulers and markets for recyclable materials. This list is provided for information only and is not necessarily comprehensive; other haulers and markets are acceptable.
- a. CAL-MAX: [www.calrecycle.ca.gov/calmax/](http://www.calrecycle.ca.gov/calmax/).
    - 1) A free service designed to help businesses find markets for non-hazardous materials they have traditionally discarded.
  - b. General Recycling/Reuse Centers: For information on qualified local solid waste haulers contact the California Department of Resources Recycling and Recovery - CalRecycle. The website lists wastes recycling facilities in counties throughout the State of California.
    - 1) <http://www.calrecycle.ca.gov/default.asp>
- I. Methods of trash/waste disposal that are not acceptable are:
- 1. Burning on the project site.
  - 2. Burying on the project site.
  - 3. Dumping or burying on other property, public or private.
  - 4. Other illegal dumping or burying.
  - 5. Incineration, either on- or off-site.
- J. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 10 00 - Site Clearing: Handling and disposal of land clearing debris.

## 1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.



- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
  - 1. Debris that is not hazardous as defined in CalGreen Section 5.408.2 and California Code of Regulations, Title 22, Section 66261.3 et seq.
  - 2. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel.
  - 3. The debris may be commingled with rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.
- 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. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes.
- E. Enforcement Agency (EA). Enforcement agency as defined in CA Public Resources Code 40130.
- F. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- G. Landfill, Inert waste or Inert Disposal Facility:
  - 1. A disposal facility that accepts only inert waste such as soil and rock, fully cured asphalt paving, uncontaminated concrete (including fiberglass or steel reinforcing rods embedded in the concrete), brick, glass, and ceramics, for land disposal.
- H. Landfill, Class III:
  - 1. A landfill that accepts non-hazardous resources such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations.
  - 2. A Class III landfill must have a solid waste facilities permit from the California Integrated Waste Management Board (CIWMB) and is regulated by the Enforcement Agency (EA).
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A processing facility that accepts loads of commingled construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing the non-recyclable residual materials.
- K. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- L. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- M. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

- N. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- O. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- P. Recycling Center: A facility that receives only C&D material that has been separated for reuse prior to receipt, in which the residual (disposed) amount of waste in the material is less than 10% of the amount separated for reuse by weight.
- Q. Return: To give back reusable items or unused products to vendors for credit.
- R. Reuse: To reuse a construction waste material in some manner on the project site.
- S. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- T. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- U. Separated for Reuse:
  - 1. Materials, including commingled recyclables.
  - 2. Separated or kept separate from the solid waste stream for the purpose of:
    - a. Additional sorting or processing those materials for reuse or recycling.
      - 1) In order to return them to the economic mainstream in the form of raw material for new, reused, or reconstituted products.
    - b. Products shall meet the quality standards necessary to be used in the marketplace.
    - c. Includes materials that have been "source separated".
- V. Solid Waste:
  - 1. All putrescible and nonputrescible solid, semisolid, and liquid wastes, including:
    - a. Garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes.
    - b. Abandoned vehicles and parts thereof.
    - c. Discarded home and industrial appliances.
    - d. Dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste.
    - e. Manure, vegetable or animal solid and semisolid wastes.
    - f. Other discarded solid and semisolid wastes.
  - 2. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by State law.
- W. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

1. Materials, including commingled recyclables, that have been separated or kept separate from the solid waste stream at the point of generation, for the purpose of additional sorting or processing of those materials for reuse or recycling in order to return them to the economic mainstream in the form of raw materials for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace.
- X. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- Y. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- Z. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- AA. Waste Hauler: A company that possesses a valid permit from the local waste management authority to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal in the locality.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Submit Waste Management Plan within 30 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
  1. Submit four copies of CWMP for review.
    - a. Contractor's Construction Waste and Recycling Plan must be approved by the Architect and Construction Manager prior to the start of Work.
  2. Approval of the Contractor's CWMP shall not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
- C. Waste Management Plan: Include the following information:
  1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
  2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
  3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
    - a. List each material proposed to be salvaged, reused, or recycled.
    - b. List the local market for each material.
  4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
  5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.

6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
  7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.
- D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
    - a. Inert materials shall achieve a construction waste diversion rate of at least 95 percent.
      - 1) These materials include, but are not limited to, concrete, asphalt and rock.
      - 2) Earthwork is not included.
      - 3) Excavated soil shall not be included in any of the calculations used to ensure compliance with this specification section.
    - b. The overall diversion rate must be based on weight.
    - c. The diversion rate of individual materials can be measured in either weight or volume, but the rate shall be converted into the units selected for calculating the overall diversion rate.
      - 1) All individual material diversions must be converted to a consistent set of units when calculating the overall diversion rate for the all reports and submittals required for the Work.
    - d. Conversion rate numbers shall be based on standard conversion rate data for construction projects provided by the California Integrated Waste Management Board (CIWMB). This data is available at the following internet location, <https://www.calrecycle.ca.gov/LGCentral/Library/Guidance/>.
  2. Submit Report on a form acceptable to Owner.
  3. Landfill Disposal: Include the following information:
    - a. Identification of material.
    - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
    - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
    - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
  4. Recycled and Salvaged Materials: Include the following information for each:
    - a. Identification of material, including those retrieved by installer for use on other projects.
    - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.

- c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
  - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
  - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
- 5. Material Reused on Project: Include the following information for each:
  - a. Identification of material and how it was used in the project.
  - b. Amount, in tons or cubic yards.
  - c. Include weight tickets as evidence of quantity.
- 6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

## **PART 2 PRODUCTS**

### **2.01 PRODUCT SUBSTITUTIONS**

- A. See Section 01 60 00 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00:
  - 1. Relative amount of waste produced, compared to specified product.
  - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
  - 3. Proposed disposal method for waste product.
  - 4. Markets for recycled waste product.

## **PART 3 EXECUTION**

### **3.01 WASTE MANAGEMENT PROCEDURES**

- A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

### **3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION**

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
  - 1. Prebid meeting.
  - 2. Preconstruction meeting.
  - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
  - 1. As a minimum, provide:
    - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
    - b. Separate dumpsters for each category of recyclable.
    - c. Recycling bins at worker lunch area.
  - 2. Provide containers as required.
  - 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
  - 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
  - 5. Locate enclosures out of the way of construction traffic.
  - 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
  - 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
  - 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

### **3.03 DISPOSAL OPERATIONS AND WASTE HAULING**

- A. Remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except for items or materials to be salvaged, recycled, or otherwise reused.
2. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on site.
3. Use a permitted waste hauler or Contractor's trucking services and personnel. To confirm valid permitted status of waste haulers, contact the local solid waste authority.
4. Become familiar with the conditions for acceptance of new construction, excavation and demolition materials at recycling facilities, prior to delivering materials.
5. Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.
6. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
7. Do not burn or bury waste materials on or off site. Appropriate on-site topical application of ground gypsum or wood, or use of site paving as granulated fill is considered reuse, not waste.

#### **3.04 PLAN AND REPORT FORMS**

- A. See suggested forms on the following pages.

**END OF SECTION**

## CONTRACTOR'S CONSTRUCTION WASTE AND RECYCLING PLAN

(Submit After Award of Contract and Prior to Start of Work)

Project Title:						
Contract or Work Order No.:						
Contractor's Name:						
Street Address:						
City:				State:		Zip:
Phone: (    )				Fax: (    )		
E-Mail Address:						
Prepared by: (Print Name)						
Date Submitted:						
Project Period:		From:			TO:	
Reuse, Recycling or Disposal Processes To Be Used						
Describe the types of recycling processes or disposal activities that will be used for material generated in the project. Indicate the type of process or activity by number, types of materials, and estimated quantities that will be recycled or disposed in the sections below:						
01 - Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick)						
02 - Salvaging building materials or salvage items at an offsite salvage or re-use center (i.e. lighting, fixtures)						
03 - Recycling source separated materials on site (i.e. crushing asphalt/concrete for reuse or grinding for mulch)						
04 - Recycling source separated materials at an offsite recycling center (i.e. scrap metal or green materials)						
05 - Recycling commingled loads of C&D materials at an offsite mixed debris recycling center or transfer station						
06 - Recycling material as Alternative Daily Cover at landfills						
07 - Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).						
08 - Disposal at a landfill or transfer station.						
09 - Other (please describe) _____						
Types of Material To Be Generated						
Use these codes to indicate the types of material that will be generated on the project						
A = Asphalt		C = Concrete		M = Metals		I = Mixed Inert    G = Green Materials
D = Drywall		P/C=Paper/Cardboard		W/C = Wire/Cable		S= Soils (Non Hazardous)
M/C = Miscellaneous Construction Debris		R = Reuse/Salvage		W = Wood		O = Other (describe)
Facilities Used: Provide Name of Facility and Location (City)						
Total Truck Loads: Provide Number of Trucks Hauled from Site During Reporting Period						
Total Quantities: If scales are available at sites, report in tons. If not, quantify by cubic yards. For salvage/reuse items, quantify by estimated weight (or units).						
SECTION I - RE-USED/RECYCLED MATERIALS						
Include all recycling activities for source separated or mixed material recycling centers where recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) M	04	ABC Metals, Los Angeles	24	355		
a. Total Diversion						



# CONTRACTOR'S CONSTRUCTION WASTE AND RECYCLING PLAN

Continued

SECTION II - DISPOSED MATERIALS						
Include all disposal activities for landfills, transfer stations, or inert landfills where no recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) D	08	DEF Landfill, Los Angeles	2	35		
b. Total Disposal				0	0	0

SECTION III - TOTAL MATERIALS GENERATED			
This section calculates the total materials to be generated during the project period (Reuse/Recycle + Disposal = Generation)			
	Tons	Cubic YD	Other Wt.
a. Total Reused/Recycled	0	0	0
b. Total Disposed	0	0	0
c. Total Generated	0	0	0

SECTION IV - CONTRACTOR'S LANDFILL DIVERSION RATE CALCULATION			
Add totals from Section I + Section II			
	Tons	Cubic YD	Other Wt.
a. Materials Re-Used and Recycled	0		
b. Materials Disposed	0		
c. Total Materials Generated (a. + b. = c.)	0	0	0
d. Landfill Diversion Rate (Tonnage Only)*			

\* Use tons only to calculate recycling percentages: Tons Reused/Recycled/Tons Generated = % Recycled

Contractor's Comments (Provide any additional information pertinent to planned reuse, recycling, or disposal activities):

## Notes:

- |  |  |
|--|--|
| 1. Suggested Conversion Factors: From Cubic Yards to Tons<br>(Use when scales are not available) | c. Ferrous Metals: .22 (ex. 1000 CY Ferrous Metal = 220 tons)          |
| a. Asphalt: .61 (ex. 1000 CY Asphalt = 610 tons. Applies to broken chunks of asphalt)            | d. Non-Ferrous Metals: .10 (ex. 1000 CY Non-Ferrous Metals = 100 tons) |
| b. Concrete: .93 (ex. 1000 CY Concrete = 930 tons. Applies to broken chunks of concrete)         | e. Drywall Scrap: .20  |
|  | f. Wood Scrap: .16   |

# CONTRACTOR'S REUSE, RECYCLING, AND DISPOSAL REPORT

(Submit With Each Progress Payment)

Project Title:						
Contract or Work Order No.:						
Contractor's Name:						
Street Address:						
City:				State:		Zip:
Phone: (    )				Fax: (    )		
E-Mail Address:						
Prepared by: (Print Name)						
Date Submitted:						
Project Period:		From:		TO:		
Reuse, Recycling or Disposal Processes to Be Used						
Describe the types of recycling processes or disposal activities that will be used for material generated in the project. Indicate the type of process or activity by number, types of materials, and estimated quantities that will be recycled or disposed in the sections below:						
01 - Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick)						
02 - Salvaging building materials or salvage items at an offsite salvage or re-use center (i.e. lighting, fixtures)						
03 - Recycling source separated materials on site (i.e. crushing asphalt/concrete for reuse or grinding for mulch)						
04 - Recycling source separated materials at an offsite recycling center (i.e. scrap metal or green materials)						
05 - Recycling commingled loads of C&D materials at an offsite mixed debris recycling center or transfer station						
06 - Recycling material as Alternative Daily Cover at landfills						
07 - Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).						
08 - Disposal at a landfill or transfer station.						
09 - Other (please describe) _____						
Types of Material To Be Generated						
Use these codes to indicate the types of material that will be generated on the project						
A = Asphalt		C = Concrete		M = Metals		I = Mixed Inert    G = Green Materials
D = Drywall		P/C=Paper/Cardboard		W/C = Wire/Cable		S= Soils (Non-Hazardous)
M/C = Miscellaneous Construction Debris		R = Reuse/Salvage		W = Wood		O = Other (describe)
Facilities Used: Provide Name of Facility and Location (City)						
Total Truck Loads: Provide Number of Trucks Hauled from Site During Reporting Period						
Total Quantities: If scales are available at sites, report in tons. If not, quantify by cubic yards. For salvage/reuse items, quantify by estimated weight (or units).						
SECTION I - RE-USED/RECYCLED MATERIALS						
Include all recycling activities for source separated or mixed material recycling centers where recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) M	04	ABC Metals, Los Angeles	24	355		
a. Total Diversion						

# CONTRACTOR'S REUSE, RECYCLING, AND DISPOSAL REPORT

Continued

SECTION II - DISPOSED MATERIALS						
Include all disposal activities for landfills, transfer stations, or inert landfills where no recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) D	08	DEF Landfill, Los Angeles	2	35		
b. Total Disposal						

SECTION III - TOTAL MATERIALS GENERATED			
This section calculates the total materials to be generated during the project period (Reuse/Recycle + Disposal = Generation)			
	Tons	Cubic YD	Other Wt.
a. Total Reused/Recycled			
b. Total Disposed			
c. Total Generated			

SECTION IV - CONTRACTOR'S LANDFILL DIVERSION RATE CALCULATION			
Add totals from Section I + Section II			
	Tons	Cubic YD	Other Wt.
a. Materials Re-Used and Recycled			
b. Materials Disposed			
c. Total Materials Generated (a. + b. = c.)			
d. Landfill Diversion Rate (Tonnage Only)*			

\* Use tons only to calculate recycling percentages: Tons Reused/Recycled/Tons Generated = % Recycled

Contractor's Comments (Provide any additional information pertinent to planned reuse, recycling, or disposal activities):

## Notes:

1. Suggested Conversion Factors: From Cubic Yards to Tons  
(Use when scales are not available)

- a. Asphalt: .61 (ex. 1000 CY Asphalt = 610 tons. Applies to broken chunks of asphalt)
- b. Concrete: .93 (ex. 1000 CY Concrete = 930 tons. Applies to broken chunks of concrete)

c. Ferrous Metals: .22 (ex. 1000 CY Ferrous Metal = 220 tons)

d. Non-Ferrous Metals: .10 (ex. 1000 CY Non-Ferrous Metals = 100 tons)

e. Drywall Scrap: .20

f. Wood Scrap: .16

## **SECTION 01 76 10 TEMPORARY PROTECTIVE COVERINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Temporary protective coverings for installed floors, walls, and other surfaces.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A135.4 - Basic Hardboard.
- B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes available; and installation instructions.
- C. Shop Drawings: Indicate existing finished surfaces to be protected.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Temporary Protective Coverings:
  - 1. Fortifiber Building Systems Group: [fortifiber.com](http://fortifiber.com).
  - 2. Protex Products: [www.protex-products.com](http://www.protex-products.com).
  - 3. Surface Shields, Inc: [www.surfaceshields.com](http://www.surfaceshields.com).
- B. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 GENERAL**

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
  - 1. Water resistant.
  - 2. Vapor permeable.

3. Impact resistant.
4. Slip resistant.
5. Flame retardant.

## **2.03 MATERIALS**

### **A. Sheet Materials:**

1. Corrugated polypropylene sheet.
2. Recycled paperboard/plastic composite sheet.
3. Recycled paperboard sheet.
4. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch thick nominal.
5. Plywood, 1/2 inch thick nominal.
6. Fiberboard: ASTM C208, 1/2 inch thick nominal.
7. Water Vapor Permeability: Greater than 0.1 perms when tested in accordance with ASTM E96/E96M.
8. Flame Retardance: Meet requirements of NFPA 701.
9. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

### **B. Rolled Materials:**

1. Self-adhering polyethylene film.
2. Recycled cellulose fiberboard paper.
3. Laminated glass fiber reinforced kraft paper.
4. Rosin coated paper.
5. Water Vapor Permeability: Greater than 0.1 perms when tested in accordance with ASTM E96/E96M.
6. Flame Retardance: Meet requirements of NFPA 701.
7. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

### **C. Corner and Door Jamb Protection Materials:**

1. Cardboard, shaped specifically for application.
2. PVC plastic.

### **D. Tape: Type recommended by protective covering material manufacturer.**

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Remove dirt and debris from surfaces to be protected.

### **3.02 INSTALLATION**

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

- B. Trim or overlap sheet materials to fit area to be covered.
- C. Roll out and cut rolled materials to fit area to be covered.
- D. Tape seams. Avoid taping directly to finished surfaces.
- E. Stretch self-adhering film materials to completely cover surface.
- F. Install door jamb protection to full height of opening.
- G. Position corner protection 4 inches above finished floor to 96 inches high.

### **3.03 REMOVAL**

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

**END OF SECTION**

## **SECTION 01 78 00 CLOSEOUT SUBMITTALS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

#### **1.02 RELATED REQUIREMENTS**

- A. Owner issued Bidding Instructions and Contract General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 45 33 - Code-Required Special Inspections: Construction oversight procedures by AHJ regarding the execution, approval, and closeout of this building project.
- D. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- E. Section 01 78 39 - Project Record Documents: Detailed requirements.
- F. Individual Product Sections: Specific requirements for operation and maintenance data.
- G. Individual Product Sections: Warranties required for specific products or Work.
  - 1. Special Project warranty requirements for specific products or elements of the Work; commitments and agreements for continuing services to Owner.

#### **1.03 DEFINITIONS**

- A. Warranty: Assurance to Owner by Contractor, installer, supplier, manufacturer or other party responsible as warrantor, for the quantity, quality, performance and other representations of a product, system service of the Work, in whole or in part, for the duration of the specified period of time.
- B. Guarantee: Assurance to Owner by Contractor or product manufacturer or other specified party, as guarantor, that the specified warranty will be fulfilled by the guarantor in the event of default by the warrantor.
- C. Standard Product Warranty: Preprinted, written warranty published by product manufacturer for particular products and specifically endorsed by the manufacturer to the Owner.
- D. Special Project Warranty: Written warranty required by or incorporated into Contract Documents, to extend time limits provided by standard warranty or to provide greater rights for Owner.
- E. Correction Period: As defined in the Conditions of the Contract, Correction Period shall be synonymous with "warranty period", "guarantee period" and similar terms used in the Contract Specifications.

#### **1.04 SUBMITTALS**

- A. Advance Submittals: For equipment and systems, or component parts of systems, put into service during construction and operated by Owner, submit documents within ten days of start of operation by Owner.
- B. Final Completion Submittals: Prior to application for final payment, Contractor shall submit 3 copies the following:
  - 1. Agency Document Submittals: Submit to Owner all documents required by authorities having jurisdiction, including serving utilities and other agencies. Submit original versions of all permit cards, with final sign-off by inspectors. Submit all certifications of inspections and tests.
    - a. Complete all required Contractor forms and obtain AHJ approval of these same forms. Comply with "Final Certification of Construction" per Title 24 Part 1 section 4-339.
      - 1) Form-6.C: Verified Report – Contractor: From each Contractor having a contract with the Owner.
  - 2. Final Specifications Submittals: Submit to Owner all documents and products required by Specifications to be submitted, including the following:
    - a. Project record drawings and specifications.
    - b. Operating and maintenance data.
    - c. Guarantees, warranties and bonds.
    - d. Keys and keying schedule.
    - e. Spare parts and extra stock.
    - f. Test reports and certificates of compliance.
  - 3. Certificates of Compliance and Test Report Submittals: Submit to Owner certificates and reports as specified and as required by authorities having jurisdiction, including the following:
    - a. Sterilization of water systems.
    - b. Sanitary sewer system tests.
    - c. Gas system tests.
    - d. Lighting, power and signal system tests.
    - e. Ventilation equipment and air balance tests.
    - f. Fire sprinkler system tests.
    - g. Fire detection system, smoke alarms and dampers.
    - h. Roofing inspections and tests.
  - 4. Lien and Bonding Company Releases: Submit to Owner, with copy to Architect, evidence of satisfaction of encumbrances on Project by completion and submission of The American Institute of Architects Forms:
    - a. G706 - Contractor's Affidavit of Payment of Debts and Claims;
    - b. G706A - Contractor's Affidavit of Release of Liens;
    - c. (if applicable) G707 - Consent of Surety;
    - d. or forms as as agreed to by the Owner.
    - e. Comply also with other requirements of Owner, as directed.



- f. All signatures shall be notarized.
- 5. Subcontractor List: Submit two copies to Owner and two copies to Architect of updated Subcontractor and Materials Supplier List.
- 6. Warranty Documents: Prepare and submit to Owner all warranties and bonds as specified in Contract General Conditions and this Section.
- C. Project Record Documents: Submit final progress markup PDF documents by uploading via Bluebeam to Architect with claim for final Application for Payment.
- D. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- E. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Final Inspection, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Final Inspection, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

#### **1.05 WARRANTIES AND GUARANTEES**

- A. General:
  - 1. Provide all warranties and guarantees with Owner named as beneficiary.
  - 2. For equipment and products, or components thereof, bearing a manufacturer's warranty or guarantee that extends for a period of time beyond the Contractor's warranty and guarantee, so state in the warranty or guarantee.
- B. Provisions for Special Warranties: Refer to Conditions of the Contract for terms of the Contractor's special warranty of workmanship and materials.
- C. General Warranty and Guarantee Requirements:
  - 1. Warranty shall be an agreement to repair or replace, without cost and undue hardship to Owner, Work performed under the Contract which is found to be defective during the Correction Period (warranty or guarantee) period.
  - 2. Repairs and replacements due to improper maintenance or operation, or due to normal wear, usage and weathering are excluded from warranty requirements unless otherwise specified.

- D. Specific Warranty and Guarantee Requirements: Specific requirements are included in product Specifications Technical Sections, including content and limitations.
- E. Disclaimers and Limitations:
  - 1. Manufacturer's disclaimers and limitations on product warranties and guarantees shall not relieve Contractor of responsibility for warranty and guarantee requirements.
  - 2. This applies to the Work that incorporates such products, nor shall they relieve suppliers, manufacturers, and installers required to countersign special warranties with Contractor.
- F. Related Damages and Losses: When correcting warranted Work that has been found defective, remove and replace other Work that has been damaged as a result of such defect or that must be removed and replaced to provide access for correction of warranted Work.
- G. Reinstatement of Warranty:
  - 1. When Work covered by a warranty has been found defective and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.
  - 2. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- H. Replacement Cost:
  - 1. Upon determination that Work covered by a warranty has been found to be defective, replace or reconstruct the Work to a condition acceptable to Owner, complying with applicable requirements of the Contract Documents.
  - 2. Contractor is responsible for all costs for replacing or reconstructing defective Work regardless of whether Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- I. Owner's Recourse:
  - 1. Written warranties made to the Owner are in addition to implied warranties, and do not limit the duties, obligations, rights and remedies otherwise available under law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 2. Rejection of Warranties:
    - a. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- J. Warranty as Condition of Acceptance:
  - 1. Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment shall be required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 PROJECT RECORD DOCUMENTS**

- A. See also Section 01 78 39 - Project Record Documents.

- B. Record Documents are to be maintained and submitted in searchable live electronic format (PDF), unflattened.
  - 1. Develop in compliance with Section 01 30 00 - Administrative Requirements.
  - 2. Acceptable markup software:
    - a. Adobe Acrobat Professional.
    - b. Bluebeam Revu.
- C. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Contract Drawings.
  - 2. Project Manual with Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- D. Ensure entries are complete and accurate, enabling future reference by Owner.
- E. Store record documents separate from documents used for construction.
- F. Record information concurrent with construction progress.
- G. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Manufacturer's name and product model and number.
  - 2. Product substitutions or alternates utilized.
  - 3. Changes made by Addenda and modifications.
  - 4. Provide copies of all approved addenda, directives, corrections, and change orders affecting the associated project.
    - a. These copies shall be included with the "Bid Set" and/or "Record Set" listed above and formatted as detailed above.
- H. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Reproducible (PDF) set of Contract Drawings will be provided to Contractor by Owner through Architect or Owner Representative.
  - 2. Measured depths of foundations in relation to finish first floor datum.
  - 3. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 5. Field changes of dimension and detail.
  - 6. Details not on original Contract drawings.
    - a. Application of copies of details produced and provided by Architect during construction will be accepted.

7. Sketches, clarifications (RFI's), Field Orders, Supplemental Instructions, Construction Change Documents, and Approved Change Orders
- I. Submission: Submit by uploading, Record Documents to Architect prior to each Application for Payment.
  1. Provide, by email, to the Architect, a download link the Record Documents consisting of an unflattened PDF format with live text and redline mark-ups, not scanned.
  2. Maintain one additional paper copy and one in PDF format (on CD) of the fire suppression and fire protection detection system drawings and specifications at the building premises.
    - a. One copy is to be kept on site for a period of three years to comply with CFC section 901.6.2.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
  1. Product data, with catalog number, size, composition, and color and texture designations.
  2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.
  3. Include performance curves, with engineering data and tests.
  4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
  - C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.
  - D. Include color coded wiring diagrams as installed.
  - E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
  - F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
    1. Include HVAC outdoor and exhaust air damper calibration strategy.
      - a. Include provisions which ensure that full closure of dampers can be achieved.
    2. Include Carbon Dioxide Monitoring Protocol.
  - G. Provide servicing and lubrication schedule, and list of lubricants required.
  - H. Include manufacturer's printed operation and maintenance instructions.
  - I. Include sequence of operation by controls manufacturer.
  - J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
  - K. Provide control diagrams by controls manufacturer as installed.
  - L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
  - M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
  - N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
    1. Parts Data:
      - a. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams as necessary for service and maintenance.
      - b. Include complete nomenclature and catalog numbers for consumable and replacement parts.
      - c. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in stock by the Owner or operator.
  - O. Include test and balancing reports.
  - P. Additional Requirements: As specified in individual product specification sections.

### **3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
  - 1. Provide duplicate electronic formatted (PDF) versions of the O&M binder for record purposes. Organize the same as the printed versions.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Product data, shop drawings, and other submittals.
    - c. Operation and maintenance data.
    - d. Field quality control data.
    - e. Photocopies of warranties and bonds.
  - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

### **3.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Final Acceptance is determined.

- B. Project Warranty and Guarantee Forms:
1. Example forms for special Project warranties and guarantees are included at the end of this Section.
  2. Prepare written documents utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer.
    - a. Submit a draft to Owner through Architect for approval prior to final execution.
  3. Refer to product Technical Specifications Sections for specific content requirements, and particular requirements for submittal of special warranties.
  4. Prepare standard warranties and guarantees, excepting manufacturers' standard printed warranties and guarantees, on Contractor's, subcontractor's, material supplier's, or manufacturer's own letterhead, addressed to Owner.
  5. Warranty and guarantee letters shall be signed by all responsible parties and by Contractor in every case, with modifications only as approved in advance by Owner to suit the conditions pertaining to the warranty or guarantee.
- C. Manufacturer's Guarantee Form:
1. Manufacturer's guarantee form may be used in lieu of special Project form included at the end of this Section.
  2. Manufacturer's guarantee form shall contain appropriate terms and identification, ready for execution by the required parties.
  3. If proposed terms and conditions restrict guarantee coverage or require actions by Owner beyond those specified, submit draft of guarantee to Owner through Architect for review and acceptance before performance of the Work.
  4. In other cases, submit draft of guarantee to Owner through Architect for approval prior to final execution of guarantee.
- D. Signatures: Signatures shall be by person authorized to sign warranties, guarantees and bonds on behalf of entity providing such warranty, guarantee or bond.
- E. Co-Signature: All installer's warranties and bonds shall be co-signed by Contractor. Manufacturer's guarantees will not require co-signature.
- F. Verify that documents are in proper form, contain full information, and are notarized.
- G. Co-execute submittals when required.
- H. Retain warranties and bonds until time specified for submittal.
- I. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- J. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
1. If more than one volume of warranties, guarantees and bonds is produced, identify volume number on binder.
- K. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

- L. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- M. Form of Warranty and Bond Submittals:
  - 1. Prior to final Application and Certificate for Payment, compile two copies of each required warranty, guarantee and bond, properly executed by Contractor, or jointly by Contractor, subcontractor, supplier, or manufacturer.
  - 2. Collect and assemble all written warranties and guarantees into binders and deliver binders to Owner for final review and acceptance.
  - 3. Include Table of Contents for binder, neatly typed, following order and Section numbers and titles as used in the Project Manual.
  - 4. Provide heavy paper dividers with celluloid or plastic covered tabs for each separate warranty.
    - a. Mark tabs to identify products or installation, and Section number and title.
  - 5. Include on separate typed sheet, if information is not contained in warranty or guarantee form, a description of the product or installation, and the name, address, telephone number and responsible person for applicable installer, supplier and manufacturer.
  - 6. When operating and maintenance data manuals are required for warranted construction, include additional copies of each required warranty and guarantee in each required manual.
    - a. Coordinate with requirements listed in the prior articles for operating and maintenance data manuals.

### **3.07 TIME OF WARRANTY AND BOND SUBMITTALS**

- A. Submission of Preliminary Copies:
  - 1. Unless otherwise specified, obtain preliminary copies of warranties, guarantees and bonds within ten days of completion of applicable item or Work.
  - 2. Prepare and submit preliminary copies for review as specified herein.
- B. Submission of Final Copies:
  - 1. Submit fully executed copies of warranties, guarantees and bonds within ten days of date identified in Certificate of Completion but no later than three days prior to date of final Application for Payment.
- C. Date of Warranties and Bonds:
  - 1. Unless otherwise directed or specified, commencement date of warranty, guarantee and bond periods shall be the date established in the Certificate of Completion.
  - 2. Warranties for Work accepted in advance of date stated in Certificate of Completion:
    - a. When a designated system, equipment, component parts or other portion of the Work is completed and occupied or put to beneficial use by Owner:
      - 1) By separate agreement with Contractor, prior to completion date established in the Certificate of Completion, submit properly executed warranties to Owner within ten days of completion of that designated portion of the Work.



- 2) List date of commencement of warranty, guarantee or bond period as the date established in the Certificate of Completion.
3. Warranties for Work not accepted as of date established in the Certificate of Completion:
  - a. Submit documents within ten days after acceptance, listing date of acceptance as beginning of warranty, guarantee or bond period.
- D. Duration of Warranties and Guarantees:
  1. Unless otherwise specified or prescribed by law, warranty and guarantee periods shall be not less than the Correction Period required by the Conditions of the Contract.
  2. In no case, the period is to be less than one year from the date established for completion of the Project in the Certificate of Completion.
  3. See product Specifications Sections of the Project Manual for extended warranty and guarantee beyond the minimum one year duration.

**END OF SECTION**

**SECTION 01 78 00.01  
WARRANTY FORM LETTER**

**FOR CONTRACTOR'S / SUBCONTRACTOR'S / MANUFACTURER'S WARRANTY**

CONTRACTOR'S/SUBCONTRACTOR'S/SUPPLIER'S LETTERHEAD

**SPECIAL LIMITED PROJECT WARRANTY FOR \_\_\_\_\_ WORK.**

We, the undersigned, do hereby warrant that the portion of the Work described above which we have provided for Big Bear Administrative Facility is in accordance with the Contract Documents and that all such Work as installed will fulfill or exceed all minimum warranty requirements.

We agree to repair or replace Work installed by us, together with any adjacent Work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or function within a period of (years), commencing (date identified in Certificate of Completion, unless otherwise directed) and terminating (date).

The following terms and conditions apply to this warranty (obtain Owner 's approval before submission):

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

**LOCAL REPRESENTATIVE: FOR WARRANTY MAINTENANCE, REPAIR, OR REPLACEMENT SERVICE, CONTACT:**

(Name) \_\_\_\_\_  
(Address) \_\_\_\_\_  
(City) \_\_\_\_\_ (State) \_\_\_\_\_ (ZIP) \_\_\_\_\_  
(Phone) \_\_\_\_\_ / \_\_\_\_\_  
(signed) \_\_\_\_\_  
(Typed Name) \_\_\_\_\_ (Date) \_\_\_\_\_  
(Title) \_\_\_\_\_ (Firm) \_\_\_\_\_

**CONTRACTOR:**

State License No: \_\_\_\_\_  
(signed) \_\_\_\_\_  
(Date) \_\_\_\_\_ (Typed Name) \_\_\_\_\_  
(Title) \_\_\_\_\_ (Firm) \_\_\_\_\_

**FORM LETTER**

**FOR CONTRACTOR'S / MANUFACTURER'S GUARANTEE**

CONTRACTOR'S / MANUFACTURER'S LETTERHEAD

**SPECIAL LIMITED PROJECT [\_\_WARRANTY\_\_] [\_\_GUARANTEE\_\_] FOR \_\_\_\_\_ WORK.**

We, the undersigned, do hereby [\_\_warranty\_\_] [\_\_guarantee\_\_] that the portion of the Work described above which [\_\_we have provided\_\_] [\_\_was provided by (Installer or Subcontractor's Name)\_\_] for Big Bear Administrative Facility in accordance with the Contract Documents and that all such Work as installed will fulfill or exceed all minimum warranty requirements. We agree to repair or replace Work installed by [\_\_us,\_\_] [\_\_(Installer or Subcontractor's Name)\_\_] together with any adjacent Work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or function within a period of (years), commencing (date indicated in Certificate of Completion, unless otherwise directed) and terminating (date).

The following terms and conditions apply to this [\_\_warranty\_\_] [\_\_guarantee\_\_] (obtain Owner's approval before submission):

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

**LOCAL REPRESENTATIVE: FOR WARRANTY MAINTENANCE, REPAIR, OR REPLACEMENT SERVICE, CONTACT:**

(Name) \_\_\_\_\_  
(Address) \_\_\_\_\_  
(City) \_\_\_\_\_ (State) \_\_\_\_\_ (ZIP) \_\_\_\_\_  
(Phone) \_\_\_\_\_ / \_\_\_\_\_  
(signed) \_\_\_\_\_  
(Date) \_\_\_\_\_ (Typed Name) \_\_\_\_\_  
(Title) \_\_\_\_\_ (Firm) \_\_\_\_\_

**CONTRACTOR:**

State License No: \_\_\_\_\_  
(signed) \_\_\_\_\_  
(Date) \_\_\_\_\_ (Typed Name) \_\_\_\_\_  
(Title) \_\_\_\_\_ (Firm) \_\_\_\_\_

**FORM LETTER**

**SECTION 01 78 39**  
**PROJECT RECORD DOCUMENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Record Drawings.
- B. Record Specifications.
- C. Record Product Data.
- D. Record Samples.
- E. Record Photos.
- F. Miscellaneous record submittals.

**1.02 RELATED REQUIREMENTS:**

- A. Section 01 20 00 - Price and Payment Procedures: Schedule of Values.
- B. Section 01 30 00 - Administrative Requirements: Project Coordination.
- C. Section 01 78 00 - Closeout Submittals: General Closeout.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Recorded actual locations.

**PART 2 -PRODUCTS - NOT USED**

**PART 3 - EXECUTION**

**3.01 RECORD DRAWINGS**

- A. Record Documents: Maintain one set of marked-up PDF copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 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 provide information for preparation of corresponding 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 acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
  - a. Field changes of dimensions from Drawings.
  - b. Revisions to details shown on Drawings.
    - 1) Details not on original Contract Drawings. Application of copies of details produced and provided by Architect during construction will be accepted.
  - c. Depths of foundations and footing, measured in relation to finish First Floor datum.
  - d. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent ground improvements.
  - e. Revisions to routing of piping and conduits.
  - f. Revisions to electrical circuits.
  - g. Actual equipment locations and sizes.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Permanent Room names and Room numbers.
  - k. Changes made by Change Order or Construction Change Directive.
  - l. Changes made following written orders by Owner or Owner Representative.
  - m. Changes made following Architect's written orders.
  - n. Note clarifications from RFI's.
  - o. Field records for variable and concealed conditions.
  - p. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
  1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
    - a. Format: DWG, Version, Microsoft Windows operating system.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Architect and Owner Representative for resolution.

4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
  - a. See Section 01 35 50 - Requests for Electronic Files for requirements related to use of Architect's digital data files.
  - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
  1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  2. Consult Architect and Owner Representative for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification:
    - a. Project name and number.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect and Owner Representative.
    - e. Name of Contractor.

### **3.02 RECORD SPECIFICATIONS**

- A. Preparation: Mark Specifications in PART 2 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.
- B. Format: Submit record Specifications as annotated PDF electronic file.

### **3.03 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.
- B. Format: Submit record Product Data as annotated PDF electronic file.
  1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

### **3.04 RECORD SAMPLES**

- A. Immediately before date of Substantial Completion, meet with Owner or Owner Representative at Project site to determine which Samples maintained during the construction period are to be transmitted to Owner or Owner Representative for record purposes.
- B. Comply with Owner or Owner Representative's instructions for packaging, identification, marking, and delivery to Owner or Owner Representative's Sample storage space. Dispose of other Samples in the manner specified for disposing surplus and waste materials

### **3.05 RECORD PHOTOS**

- A. Photograph all work before covering up, including:
  1. All open trenches and manholes shall be photographed.
  2. All exposed utilities should be identified in the photos.
  3. Show photograph locations and dates on Record Drawings.

### **3.06 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.
  1. Field records on excavations and foundations.
  2. Field records on underground construction and similar work.
  3. Surveys showing locations and elevations of underground lines.
  4. Invert elevations of drainage piping.
  5. Surveys establishing building lines and levels.
  6. Authorized measurements using unit prices or allowances.
  7. Records of plant treatment.

8. Ambient and substrate condition tests.
  9. Certifications received in lieu of labels on bulk products.
  10. Batch mixing and bulk delivery records.
  11. Testing and qualification of trade persons.
  12. Documented qualification of installation firms.
  13. Load and performance testing.
  14. Inspections and certifications by governing authorities.
  15. Leakage and water-penetration tests.
  16. Fire-resistance and flame-spread test results.
  17. Final inspection and correction procedures.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

### **3.07 SUBMISSION**

- A. Keep Project Record Documents current, as they will be reviewed for completeness by Architect, Engineer, Project Inspector, and Owner Representative; as a condition of certification for each Progress Payment Application.
- B. Prior to the date of the Notice of Completion, submit marked Record Documents to Architect and Owner Representative for review, approval and further processing.

### **3.08 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Review of documents by Architect, Engineer, Project Inspector, or Owner Representative to be in concert with approval of the monthly Application for Payment.
- C. Maintenance of Record Documents and Samples:
  1. Store record documents and Samples in the field office apart from the Contract Documents used for construction.
  2. Do not use project record documents for construction purposes.
  3. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss.
  4. Provide access to project record documents for Architect and Owner Representative reference during normal working hours.

### **END OF SECTION**



**SECTION 01 79 00**  
**DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Landscape irrigation.
  - 6. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
  - 2. Finishes, including flooring, wall finishes, ceiling finishes.
  - 3. Fixtures and fittings.
  - 4. Items specified in individual product Sections.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.
- B. Section 01 91 13 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.
- C. Other Specification Sections: Additional requirements for demonstration and training.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
  - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
  - 2. Submit one copy to the Commissioning Authority, not to be returned.
  - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
  - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word preferred.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Each Sub, Design-Build SubContractor and vendor responsible for training submits a written training plan to the Architect, Owner, Owner Representative, and Commissioning Authority for review and approval prior to training.
  2. Submit to Architect for transmittal to Owner.
  3. Submit to Commissioning Authority for review and inclusion in overall training plan.
  4. Submit not less than four weeks prior to start of training.
  5. Revise and resubmit until acceptable.
  6. Provide an overall schedule showing all training sessions.
  7. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
      - 1) Equipment list
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
      - 1) Agenda and subjects (design intent, equipment inspections, modes of operation, system interactions, troubleshooting, preventative maintenance, etc.)
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
      - 1) The approved O&M manuals shall be used during the training for equipment specific references.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
  2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
1. Identification of each training session, date, time, and duration.
  2. Sign-in sheet showing names and job titles of attendees.
  3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
  4. Include Commissioning Authority's formal acceptance of training session.

- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
  - 1. Format: DVD Disc.
  - 2. Label each disc and container with session identification and date.

#### **1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 TRAINING OF OWNER PERSONNEL**

- A. The Contractor and Design-Builder SubContractors shall be responsible for training coordination and scheduling and for ensuring that training is completed.
- B. The Commissioning Authority (CA) shall be responsible for reviewing and approving the content of the training of Owner personnel for commissioned equipment.
- C. The specific training requirements of Owner personnel by Subs, Design-Builder SubContractors and vendors is specified in the Division in which the equipment is specified.
- D. For primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
- E. All training on Commissioned equipment or systems shall be documented for LEED requirements by filling out "Training Verification Forms" provided by CA. Design-Builder SubContractors and Controls Contractor to fill out forms and submit to CxC for inclusion in Cx Report by CA

#### **3.02 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Final Inspection.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  1. Perform demonstrations not less than two weeks prior to Final Inspection.

### **3.03 TRAINING - GENERAL**

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
  1. Review the applicable O&M manuals.
  2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  4. Provide hands-on training on all operational modes possible and preventive maintenance.
  5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  6. Discuss common troubleshooting problems and solutions.
  7. Discuss any peculiarities of equipment installation or operation.
  8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.

9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

## **SECTION 01 91 13**

### **GENERAL COMMISSIONING REQUIREMENTS**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
1. Comply with Section 5.410.2 Commissioning per the California Green Building Standards Code and Section 10-103 of the California Energy Code.
    - a. California Energy Code Section 10-103 requires Acceptance Testing on all newly installed lighting controls, mechanical systems, envelopes, and process equipment after installation and before project completion. An Acceptance Test is a functional performance test to help ensure that newly installed equipment is operating and in compliance with the Energy Code.
    - b. Lighting controls acceptance tests must be performed by a certified lighting controls Acceptance Test Technician (ATT).
    - c. Mechanical system acceptance tests must be performed by a certified mechanical ATT for projects submitted on or after October 1, 2021.
    - d. Envelope and process equipment acceptance tests shall be performed by the installing contractor, engineer/architect of record or the owner's agent.
    - e. A listing of certified ATT can be found at: <https://www.energy.ca.gov/programs-and-topics/programs/acceptance-test-technician-certification-provider-program/acceptance>.
    - f. The Acceptance Testing procedures must be repeated, and deficiencies must be corrected by the builder or installing contractor until the construction/installation of the specified systems conform and pass the required acceptance criteria.
    - g. Project inspectors will collect the forms to confirm that the required Acceptance Tests have been completed.
  2. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
  3. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
  4. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
  5. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Functional Completion.
- C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.
- D. The Commissioning Authority is employed by Construction Manager on behalf of Owner.

## **1.02 SCOPE OF COMMISSIONING**

- A. The following are to be commissioned:
  - 1. Building envelope:
    - a. Thermal and moisture integrity.
    - b. Air tightness.
  - 2. Fire Protection Systems.
  - 3. Plumbing Systems:
    - a. Water heaters.
      - 1) Flow and temperature at handwashing and foodprep sinks.
    - b. Booster pumps.
    - c. Landscape irrigation.
  - 4. HVAC System, including:
    - a. Major and minor equipment items.
    - b. Piping systems and equipment.
    - c. Ductwork and accessories.
    - d. Terminal units.
    - e. Control system.
    - f. Sound control devices.
    - g. Vibration control devices.
    - h. Variable frequency drives.
  - 5. Special Ventilation:
    - a. Kitchen exhaust hoods.
    - b. Specialty fans.
  - 6. Electrical Systems:
    - a. Power quality.
    - b. Emergency power systems.
    - c. Uninterruptible power systems.
    - d. Lighting controls other than manual switches.
  - 7. Electronic Safety and Security:
    - a. Security system, including doors and hardware.
    - b. Fire and smoke alarms.

8. Communications:
  - a. Voice and data systems.
  - b. Public address/paging.
9. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
10. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 01 57 19 - Temporary Environmental Controls.

### **1.03 RELATED REQUIREMENTS**

- A. Section 01 57 19 - Temporary Environmental Controls: Precautions and procedures; smoking room testing; building flush-out.
- B. Section 01 70 00 - Execution and Closeout Requirements: General startup requirements.
- C. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.
- D. Section 01 79 00 - Demonstration and Training: Scope and procedures for Owner personnel training.

### **1.04 REFERENCE STANDARDS**

- A. CSI/CSC MF - Masterformat.
- B. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
  1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
  2. Submit one copy to the Commissioning Authority, not to be returned.
  3. Make commissioning submittals on time schedule specified by Commissioning Authority.
  4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
  5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
- B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
  1. Manufacturer's product data, cut sheets, and shop drawings.
  2. Manufacturer's installation instructions.
  3. Startup, operating, and troubleshooting procedures.
  4. Fan and pump curves.
  5. Factory test reports.
  6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.



- C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- D. Startup Plans and Reports.
- E. Completed Prefunctional Checklists.
- F. Commissioning Issues Log:
  - 1. Construction observations.
  - 2. Supporting photographs.

## **1.06 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## **PART 2 PRODUCTS**

### **2.01 TEST EQUIPMENT**

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Provide all standard testing equipment required to perform building envelope air tightness testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- C. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
  - 1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
  - 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
  - 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.
- D. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.
- E. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
  - 1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

## **PART 3 EXECUTION**

### **3.01 COMMISSIONING PLAN**

- A. Commissioning Authority will prepare the Commissioning Plan.
  - 1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
  - 2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.
- B. Contractor is responsible for compliance with the Commissioning Plan.
- C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
  - 1. Commissioning will be phased (by floors, for example) to minimize the total construction time.
- D. Basis of Design Documentation (BOD): Detailed documentation of the functional requirements of the project; descriptions of the systems, components, and methods chosen to meet the design intent; assumptions underlying the design intent.
- E. Commissioning Schedule:
  - 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
  - 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
  - 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
  - 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

### **3.02 DOCUMENTATION IDENTIFICATION SYSTEM**

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
  - 1. Startup Plan: SP-.
  - 2. Startup Report: SR-.
  - 3. Prefunctional Checklist: PC-.
  - 4. Functional Test Procedure: FTP-.
  - 5. Functional Test Report: FTR-.
- C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
  - 1. 2300: HVAC system as a whole.
  - 2. 2320: HVAC Piping and Pumps.
  - 3. 2330: HVAC Air Distribution.
- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

### **3.03 STARTUP PLANS AND REPORTS**

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority.

### **3.04 PREFUNCTIONAL CHECKLISTS**

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
  - 1. No sampling of identical or near-identical items is allowed.
  - 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
  - 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
    - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
    - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
    - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
    - d. Serial number of installed unit.
    - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
    - f. Sensor and actuator calibration information.
  - 4. A preliminary list of Prefunctional Checklists is attached, to indicate anticipated scope.
  - 5. PEI (Samples) found at <http://www.peci.org/library/mcpgs.htm> indicate anticipated level of detail for Prefunctional Checklists.
- B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
  2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
  3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
  4. If any Checklist line item is not relevant, record reasons on the form.
  5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
  6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
  7. Submit completed Checklists to Commissioning Authority within two days of completion.
  8. See Section 01 70 00 - Execution and Closeout Requirements for additional general startup requirements.
- C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
  2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
  3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
  4. When asked to review the proposed Checklists, do so in a timely manner.
- D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
  2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

### **3.05 FUNCTIONAL TESTS**

- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

- B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
  - 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
  - 2. Use the standard form provided with copies submitted to Owner and Contractor.
  - 3. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
  - 4. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
  - 5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
  - 6. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.
- E. Functional Test Procedures:
  - 1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
  - 2. Examples of Functional Testing:
    - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
    - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
    - c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.

- d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
- 3. A preliminary list of Functional Tests is attached, to indicate anticipated scope.
- 4. PECL (Samples) found at <http://www.peci.org/library/mcpgs.htm> indicated anticipated level of detail for Functional Tests.
- F. Deferred Functional Tests: Some tests may need to be performed later, after Final Inspection, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.
- G. Factory Tests: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory by factory personnel, to ensure compliance with commissioning requirements.
- H. Field Tests By Others: Where Functional Tests are indicated as to be performed by others not subject to Contract Documents, those tests are not subject to these commissioning requirements.

### **3.06 SENSOR AND ACTUATOR CALIBRATION**

- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
  - 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
  - 2. Verify that sensors with shielded cable are grounded only at one end.
  - 3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
  - 4. Tolerances for critical applications may be tighter.
- D. Sensors Without Transmitters - Standard Application:
  - 1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
  - 2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
  - 3. If not, install offset, calibrate or replace sensor.
- E. Sensors With Transmitters - Standard Application.
  - 1. Disconnect sensor.
  - 2. Connect a signal generator in place of sensor.

3. Connect ammeter in series between transmitter and building automation system control panel.
  4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
  5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
  6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
  7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
  8. Reconnect sensor.
  9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
  10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
  11. If not, replace sensor and repeat.
  12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
  2. Pressure, Air, Water, Gas: 3 percent of design.
  3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
  4. Relative Humidity: 4 percent of design.
  5. Barometric Pressure: 0.1 inch of Hg.
  6. Flow Rate, Air: 10 percent of design.
  7. Flow Rate, Water: 4 percent of design.
  8. AHU Wet Bulb and Dew Point: 2.0 degrees F.
  9. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F.
  10. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F.
  11. Combustion Flue Temperature: 5.0 degrees F.
  12. Oxygen and CO<sub>2</sub> Monitors: 0.1 percentage points.
  13. CO Monitor: 0.01 percentage points.
  14. Natural Gas and Oil Flow Rate: 1 percent of design.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
  2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
  4. Command valve/damper to open; verify position is full open and adjust output signal as required.
  5. Command valve/damper to a few intermediate positions.
  6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
  2. Use an ultra-sonic flow meter to detect flow or leakage.

### **3.07 TEST PROCEDURES - GENERAL**

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.
- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
  1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
  2. Sampling is not allowed for:
    - a. Major equipment.
    - b. Life-safety-critical equipment.
    - c. Prefunctional Checklist execution.
  3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
  4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
  5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
  6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
  7. If YY percent of the units in the second sample fail, test all remaining identical units.
  8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.



- D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.
- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
  - 1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
  - 2. Other points will be monitored by the Commissioning Authority using dataloggers.
  - 3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
  - 4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
  - 5. Graphical output is desirable and is required for all output if the system can produce it.
  - 6. Monitoring may be used to augment manual testing.

### **3.08 OPERATION AND MAINTENANCE MANUALS**

- A. See Section 01 78 00 - Closeout Submittals for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

### **END OF SECTION**

## **SECTION 01 91 14**

### **COMMISSIONING AUTHORITY RESPONSIBILITIES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:
  - 1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this.
  - 2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests performed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
  - 3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed O&M data submittals are specified.
  - 4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is specified.
- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Final Inspection.
- C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
- D. The Commissioning Authority is employed by Construction Manager on behalf of Owner.
- E. The scope of commissioning activities is defined in Section 01 91 13 - General Commissioning Requirements.
- F. Contractor's responsibilities are defined in Section 01 91 13 - General Commissioning Requirements.

##### **1.02 DEFINITIONS**

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.
- B. Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet Owner's project requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- C. Commissioning Authority (CxA): A qualified and certified firm or individual responsible for delivery of the commissioning process.

1. When applicable to a firm, indicates a entity certified through one or more of the organizations listed in the Quality Assurance article.
  2. When applicable to an individual, equivalent terms with same meaning used in this Section include: Building Commissioning Professional (BCxP); Commissioning Professional (CxP); Commissioning Process Professional (CxPP).
- D. Commissioning Process: Quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria.
  - E. Deferred Tests: Tests performed after Date of Final Inspection, with Owner's approval, due to seasonal requirements, site conditions , or both, that prohibit the tests from being performed prior to achieving Final Inspection.
  - F. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Contract Documents.
  - G. Integrated System Test: Test of multiple systems that are designed to dynamically function and operate in coordinated and properly sequenced fashion. Tests are intended to be conducted under various modes and through every specified sequence of operations.
  - H. Owner's Project Requirements (OPR): A written document that details the Owner's functional requirements of a project and the expectations of how it will be used and operated. It includes project goals, measurable performance criteria, cost considerations, applicable benchmarks, reference standards, success criteria, and supporting information.

### **1.03 REFERENCE STANDARDS**

- A. ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems.
- B. ASHRAE Std 202 - The Commissioning Process Requirements for New Buildings and New Systems.
- C. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
- D. CSI/CSC MF - Masterformat.
- E. NECA 90 - Standard for Commissioning Building Electrical Systems.
- F. NFPA 3 - Standard for Commissioning of Fire Protection and Life Safety Systems.

### **1.04 SUBMITTALS**

- A. Commissioning Plan:
  1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Authority contract.
  2. Submit revised draft to be included in the construction Contract Documents, not less than 4 weeks prior to bid date.
  3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.
- B. List of Prefunctional Checklists to be developed:
  1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.

2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
  3. Submit final list not more than 60 days after start of construction.
- C. Prefunctional Checklists:
1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
  2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
  3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.
- D. List of Functional Test procedures to be developed:
1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
  2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in Contract Documents; this is intended to be a list of titles, not full description of the tests.
  3. Submit final list not more than 60 days after start of construction.
- E. Functional Test Procedures:
1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
  2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
  3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.
- F. Training Plan.
- G. Recommissioning Manual: Submit within 60 days after receipt of Owner's instructions to proceed with preparation.
- H. Commissioning Process Record: Submit to Contractor for inclusion with O&M manuals. Include, at a minimum the following:
1. Issues Log
  2. Construction Checklists
  3. CxA Site Visit and Cx Team Meeting Minutes
  4. O & M Review
  5. Training Documentation
  6. Warranty Review
  7. Test Data Reports
  8. Summary Report
- I. Final Commissioning Report: Submit to Owner. Include the following:

1. A statement that systems have been completed in accordance with Contract Documents, and that the systems are performing in accordance with the final Owner's project requirements document.
  2. Identification and discussion of any substitutions, compromises, or variances between the final design intent, Contract Documents and as-built conditions.
  3. Description of components and systems that exceed Owner's project requirements and those which do not meet the requirements and why.
  4. Summary of issues, both resolved and unresolved, and any recommendations for resolution of remaining items.
  5. A list of post-construction activities and results including deferred & seasonal testing results, test data reports and additional training documentation.
  6. A narrative of lessons learned for future commissioning project efforts
- J. Commissioning Firm's Qualification Statement.

#### **1.05 QUALITY ASSURANCE**

- A. Commissioning Process: Conduct the commissioning process using ASHRAE Std 202 as the reference for applying the whole-building principles to facility elements.
- B. Commissioning Firm Qualifications: Firm experienced in commissioning assemblies and systems specified to be included in scope of work of this Section, and certified by one or more of the following organizations.
  1. AABC Commissioning Group (ACG), for commissioning of HVAC Systems and Special Ventilation Systems.
    - a. Commissioning Team Leader: AABC Certified Commissioning Authority (CxA). An individual with technical and management experience who leads a qualified team that plans and coordinates the commissioning process.
    - b. Commissioning Team Members: Certified Commissioning Technicians (CxT) employed by commissioning firm and working under direct supervision of CxA.
  2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) for commissioning of HVAC Systems
    - a. Commissioning Team Leader: ASHRAE Certified Building Commissioning Professional (BCxP). An individual with technical and management experience who leads a qualified team that plans and coordinates the commissioning process.
    - b. Commissioning Team Members: Technicians employed by commissioning firm and working under direct supervision of BCxP.
  3. Association of Energy Engineers (AEE) for commissioning of HVAC Systems
    - a. Commissioning Team Leader: AEE Certified Building Commissioning Professional (BCxP). An individual with technical and management experience who leads a qualified team that plans and coordinates the commissioning process.
    - b. Commissioning Team Members: Certified Commissioning Technicians (CxT) employed by commissioning firm and working under direct supervision of BCxP.
  4. Building Commissioning Association (BCA) for commissioning of HVAC Systems

- a. Commissioning Team Leader: BCA Certified Commissioning Professional (CxP). An individual with technical and management experience who leads a qualified team that plans and coordinates the commissioning process.
  - b. Commissioning Team Members: Certified Commissioning Technicians (CXT) employed by commissioning firm and working under direct supervision of CxP.
- 5. National Environmental Balancing Bureau (NEBB) for commissioning of HVAC Systems
  - a. Commissioning Team Leader: NEBB Certified Commissioning Process Professional (CxPP). An individual with technical and management experience who leads a qualified team that plans and coordinates the commissioning process.
  - b. Commissioning Team Members: Certified Commissioning Technicians (CXT) employed by commissioning firm and working under direct supervision of CxA.
- C. Commissioning Plan: Prepare a plan that provides direction for commissioning tasks during construction phase of the project. Include, at a minimum, the following content at the level of detail appropriate to project scope and complexity:
  - 1. General project information.
  - 2. List of team members.
  - 3. Team members' roles and responsibilities
  - 4. Description of the goals of the plan.
  - 5. Abbreviations and definitions used in the document.
  - 6. Scope of commissioning activities.
  - 7. Proposed overall schedule, tied to project construction schedule.
  - 8. General management plan.
  - 9. Description of the commissioning process, including documents to be used for facilitating:
    - a. Prefunctional checking and readiness verification.
    - b. Start-up plan and procedures.
    - c. Functional test plan and verification procedures.
    - d. Retesting procedures.
    - e. Management protocols for address deficiencies due to defective products or non-complying work.
    - f. Management protocols for addressing other project-specific issues.
  - 10. Phased commissioning activities, planned and unplanned.
  - 11. Warranty period seasonal and deferred testing.
  - 12. Progress reporting and log for tracking issues.
  - 13. Training and orientation of Owner's personnel above and beyond.
  - 14. Commissioning record table of contents.

## **PART 2 PRODUCTS**

### **2.01 DOCUMENTATION IDENTIFICATION SYSTEM**

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
  - 1. Commissioning Plan: CP-.
  - 2. Prefunctional Checklist: PC-.
  - 3. Functional Test Procedure: FTP-.
  - 4. Functional Test Report: FTR-.
  - 5. Commissioning Report: CR-.
- C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
  - 1. 2300: HVAC system as a whole.
  - 2. 2320: HVAC Piping and Pumps.
  - 3. 2330: HVAC Air Distribution.
- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.
- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

## **PART 3 EXECUTION**

### **3.01 COMMISSIONING PLAN**

- A. Prepare and implement the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
  - 1. Call and chair meetings of the Commissioning team when appropriate.
  - 2. Give Contractor sufficient notice for scheduling commissioning activities.
  - 3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
  - 4. Commissioning will be phased (by floors, for example) to minimize the total construction time.
  - 5. ASHRAE Guideline 1.1 may be used as a guide for the Commissioning Plan.
  - 6. Avoid replication of information included in the construction Contract Documents to the greatest extent possible.
- B. Owner's Project Requirements: As defined above.
  - 1. Prepared By: Owner.

2. Copy to be furnished to Commissioning Authority for use in preparation of the commissioning plan.
- C. Basis of Design Documentation: As defined above.
  1. Prepared By: Architect.
  2. Copy to be furnished to Commissioning Authority for use in preparation of the commissioning plan.
- D. Review the construction Contract Documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.
- E. Commissioning Schedule:
  1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
  2. Contractor's scheduling responsibilities are specified in the construction Contract Documents.
  3. Revise and re-issue schedule monthly.
  4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
  5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.
- F. Commissioning Team: Project manager or other designated person of:
  1. Owner's building or plant operation staff.
  2. Commissioning Authority.
  3. Construction Manager.
  4. Design professional's design team.
  5. General Contractor.
  6. Fire Protection subcontractor.
  7. Plumbing subcontractor.
  8. HVAC subcontractor.
  9. HVAC control system subcontractor.
  10. HVAC testing, adjusting, and balancing (TAB) subcontractor.
  11. Electrical subcontractor.
  12. Communications subcontractor.
  13. Other subcontractors who will be required to perform commissioning activities.

### **3.02 CONSTRUCTION CONTRACT DOCUMENTS**

- A. Review the OPR and BOD documents, and project design for commissioning provisions.
- B. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction Contract Documents; review and submit comments to Owner.



1. These specifications include:
  - a. Procedures applicable to all types of items to be commissioned.
  - b. General commissioning procedures for thermal and moisture protection.
  - c. General commissioning procedures for openings and fenestration systems.
  - d. General commissioning procedures for fire protection.
  - e. General commissioning procedures for plumbing.
  - f. General commissioning procedures for HVAC.
  - g. General commissioning procedures for integrated automation.
  - h. General commissioning procedures for electrical.
  - i. General commissioning procedures for communications.
2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction Contract Documents by Architect:
  - a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
  - b. Additional Owner personnel training.
  - c. Additional operation or maintenance data that should be submitted.
- C. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.
  1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.
  2. The Checklist forms are intended to be part of the Contractor's Contract Documents.
- D. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Owner and Architect.
  1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
  2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.
  3. Architect is required to prepare outlines of Functional Testing for major equipment and systems.
- E. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction Contract Documents.
- F. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction Contract Documents

### 3.03 PREFUNCTIONAL CHECKLISTS

- A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup.
1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.
  2. Identify each Checklist by using Contract Documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.
  3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.
  4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.
  5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
  6. Include line items for each physical inspection to be performed.
  7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
  8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
  9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.
- B. Prefunctional Checklists - Format:
1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
  2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
  3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
    - a. "This Checklist is submitted for approval with no exceptions."

- b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
- 4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
- 5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

### **3.04 FUNCTIONAL TEST PROCEDURES**

- A. Develop test procedures in sufficient detail to demonstrate that functional performance is in accordance with Contract Documents, including proper operation through specified modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load regimes.
  - 1. Obtain assistance and review by installing subcontractors.
  - 2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
  - 3. Include test setup instructions, description of tools and apparatus, special cautions, and.
  - 4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
  - 5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring, or manual functional testing.
  - 6. Submit to Construction Manager for review, and for approval if required.
  - 7. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.
- B. Functional Test Forms: Prepare and distribute forms in advance of testing. Use a consistent format to the greatest degree practicable. For each form, include the following:
  - 1. General and specific instructions for using form.
  - 2. Document Identifiers:
    - a. Form Identifier (see Documentation Identification Scheme).
    - b. Date and Test Party Identifier: Identification of the date(s) of the test, and the party conducting it.
  - 3. Checklist of activities required of the Contractor prior to, during, and after the testing.
  - 4. Complete testing procedure information.
    - a. Instrumentation: A listing of instrumentation and tools necessary to complete the test.
    - b. Test Instructions: Step-by-step instructions of how to complete the test, including functionality to test, and conditions under which the tests should be performed. Include instructions for returning affected systems and equipment to their as-found state at the conclusion of the tests.
    - c. Formulas to be used in calculations.

- d. Acceptance Criteria: Measurable pass/fail criteria for each step of the test, as applicable.
    - 1) Referenced Criteria: Identify the source for required performance criteria.
- 5. Test Data:
  - a. Results: Include side-by-side fillable fields for recording the expected system response and the actual response. Note observed readings, results, and adjustments.
  - b. Deficiencies: Include fillable fields for a list of any discovered deficiencies and for an explanation of how they were mitigated.
- 6. "Yes/No" checkboxes to for documenting status of completion of required testing prerequisites and procedures.
  - a. Functional Test Prerequisites Checkboxes: Include for applicable items:
    - 1) Related equipment has been started up, and start-up reports and Prefunctional Checklists have been submitted and approved, and are ready for Functional Testing.
    - 2) Control system functions for this and any interlocking systems have been programmed and are operable in accordance with Contract Documents, including final set points and schedules with debugging, loop tuning, and sensor calibrations completed.
      - (a) Include signature of controls installer.
    - 3) Incomplete items identified by Architect during closeout inspections have been corrected or completed.
    - 4) Vibration control report has been approved (if required).
  - b. Functional Test Checkboxes: Include for applicable items:
    - 1) Procedures have been reviewed and approved by the affected installer.
    - 2) Safeties and operating ranges have been reviewed.
    - 3) False loading equipment, system and procedures are ready.
    - 4) Sufficient clearance around equipment for servicing has been provided.
    - 5) Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, .
      - (a) Provide a check document completion of return to original values (include control parameters, limits, delays, lockouts, schedules, etc.)
- 7. List of Attachments.
  - a. A copy of the specified sequence of operation.
  - b. A copy of applicable schedules and setpoints.
  - c. A copy of the specified Functional Test Procedures is attached.
    - 1) Any other items on the Prefunctional Checklist or Start-up Reports that need to be re-verified.
- 8. Signature Block: Signature of the designated commissioning lead and the system and equipment installer attesting that the recorded test results are accurate.

- C. Functional Performance Testing Reports: Use completed forms specified above, supplemented with additional information or explanations.
  - 1. Precautions Taken: Identify and describe actual precautions taken and how they mitigated potential risks inherent in testing procedures.
  - 2. Instrumentation Used: If necessary, amend the original list to report the actual instrumentation and tools used.
  - 3. Description of Test Procedures: If necessary, amend in appropriate detail the original sequence of steps to report actual steps taken to complete each functional performance test and the conditions under which the tests were performed.
  - 4. Deficiencies: List any discovered deficiencies and how they were mitigated.

### **3.05 CONSTRUCTION PHASE**

- A. Coordinate the commissioning work with Contractor and Construction Manager; ensure that commissioning activities are being incorporated into the master schedule.
- B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.
- C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review proposed commissioning schedule, activities, and responsibilities with parties involved. Require attendance by every member of the Commissioning Team.
- D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least monthly.
- E. Submit periodic progress reports to Owner and Contractor.
- F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner's responsibilities are clearly defined in warranties.
- G. Review and approve submittals directly related to commissioning.
- H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.
- I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.
- J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.
- K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.
- L. Building Envelope Commissioning:
  - 1. Develop for Contractor's and Subcontractors' use project-specific checklists, each targeted for commissioning the installation of a set of related components and systems that comprise the building enclosure.

2. Review the Contractor's and Subcontractors' project-specific performance implementation plans for building enclosure, including but not limited to the implementation and use of quality control/ quality assurance processes such as:
    - a. Proposed date ranges for conducting pressure and thermographic tests.
    - b. Daily field inspections.
    - c. Work progress documentation.
    - d. Weekly audits.
    - e. Use of installation checklists for each crew.
  3. Conduct construction observation of building enclosure systems, at initial installation of work, milestone observations throughout construction, performance testing and verification of components and systems, their interfaces, and whole building performance test (if required).
  4. Weather Conditions Suitable for Building Envelope Testing:
    - a. Winds and Temperature: As the test date approaches, monitor the weather forecast for the test site. Avoid testing on days forecast to experience high winds, rain, or snow. Monitor weather forecasts prior to shipping pressure test equipment to the site. Preferred ambient weather test conditions as stated in ASTM E779 are 0 to 4 miles per hour winds and an ambient temperature range of 41 to 95 degrees F. Based on current and forecast weather conditions, coordinate scheduling for the test to occur.
    - b. Rain: Do not test during rain or if rain is anticipated during testing.
      - 1) If pneumatic hoses have been installed and exposed to rain prior to testing, ensure rainwater has not migrated into the hose ends.
      - 2) Orient all exposed pneumatic hose ends to keep them out of water puddles.
    - c. Snow: Remove snow from around and on top of the building prior to testing.
- M. Fire Protection Systems Commissioning:
1. Comply with requirements of NFPA 3.
- N. Plumbing Systems Commissioning:
1. Comply with requirements stated in applicable Division 22 sections.
- O. HVAC Commissioning:
1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
  2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
  3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
  4. Review TAB Plan prepared by Contractor.

5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
  6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
  7. Analyze trend logs and monitoring data to verify performance.
  8. Prepare a standard trend logging package of primary parameters that will provide Owner's operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems; provide any additional information needed to interpret the trend logs.
- P. Special Ventilation Systems Commissioning:
1. Comply with requirements of applicable Division 23 sections.
- Q. Integrated Automation Systems Commissioning:
1. Comply with requirements of applicable Division 23 sections.
- R. Electrical Systems Commissioning:
1. Comply with requirements of NECA 90.
- S. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by Owner, and tests by manufacturer's personnel; include documentation in O&M manuals.
- T. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.
- U. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.
- V. Operation and Maintenance Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.
- W. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

### **3.06 TRAINING**

- A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.
1. Include a 4 hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
  2. Include a 4 hour session by the Commissioning Authority on the use of the blank Prefunctional Checklists and Functional Test forms for re-commissioning purposes.
  3. Establish criteria for determining satisfactory completion of training.
- B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.
- C. Contractor will perform video recording of training sessions.

### 3.07 CLOSEOUT

- A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
  - 1. Include the Final Commissioning Plan and Final Report.
  - 2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
    - a. Design intent documentation, furnished by Architect or others.
    - b. Detailed operational sequences.
    - c. Startup plan and approved startup reports.
    - d. Filled out Prefunctional Checklists.
    - e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
    - f. Training plan and training records.
    - g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.
- B. Final Commissioning Report: Include:
  - 1. Executive summary.
  - 2. List of participants and roles.
  - 3. Brief facility description.
  - 4. Overview of commissioning scope and general description of testing and verification methods.
  - 5. For each item commissioned, an evaluation of adequacy of:
    - a. The product itself; i.e. compliance with Contract Documents.
    - b. Installation.
    - c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
    - d. O&M documentation, including design intent.
    - e. Operator training.
  - 6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
  - 7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
  - 8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
  - 9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.
    - a. Include updated Owner's Project Requirements and Basis of Design documents



- C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

### **3.08 POST-OCCUPANCY PHASE**

- A. Assist in the development of a preventative maintenance plan, a detailed operating plan or an energy and resource management plan or as-built documentation.
- B. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.
- C. On-Site Review: 10 months after Final Inspection conduct on-site review with Owner's staff.
  - 1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
  - 2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
  - 3. Make suggestions for improvements and for recording these changes in the O&M manuals.
  - 4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
  - 5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

### **END OF SECTION**

## **SECTION 02 41 00 DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selective demolition of built site elements.
  - 1. Demolition and removal of existing site improvements within Project area, as indicated on Drawings and as necessary to accomplish the Work, including:
    - a. Asphaltic concrete and portland cement concrete paving.
    - b. Abandoned underground utility lines outside of utility easement.
    - c. Pavement cutting and removal.
    - d. Debris removal.
  - 2. Handling and disposal of removed materials.
  - 3. Dewatering of excavations as necessary to control surface and sub-surface water.
- B. Selective demolition of building elements for alteration purposes.
- C. Abandonment and removal of existing utilities and utility structures.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Description of items to be removed by Owner.
- C. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- D. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- G. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- H. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.
- I. Section 31 22 00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- J. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- K. Section 32 90 00 - Planting: Relocation of existing trees, shrubs, and other plants.

- L. Section 32 90 00 - Planting: Pruning of existing trees to remain.

### 1.03 DEFINITIONS

- A. Class III Landfill: A landfill that accepts non-hazardous materials such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A Class III landfill must have a solid waste facilities permit from the State of California.
- B. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.
  - 1. Demolition Waste: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The materials may include rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.
- C. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human or animal life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.
- D. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively for the purpose of disposal.
  - 1. Inert Solids/Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete, that does not contain hazardous substances or soluble pollutants at concentrations in excess of water-quality standards established by a regional water board and does not contain significant quantities of decomposable solid waste.
- E. Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
- F. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- G. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- H. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- I. Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.
- J. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- K. Waste:
  - 1. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.

2. Solid Waste: All putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by State law.

#### **1.04 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction.
- B. CBC Ch. 33 - Safeguards During Construction.
- C. CFC Ch. 33 - Fire Safety During Construction and Demolition.
- D. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

#### **1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Construction Conference: Conduct a pre-construction conference one week prior to the start of the work of this section; require attendance by all affected trades.
- B. Convene a conference at the Project site 3 days prior to starting demolition to review the Drawings and Specifications, requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations and project conditions.
- C. Conference shall be attended by Owner Representative, supervisory and quality control personnel of Contractor and all subcontractors performing this and directly-related Work.
- D. Submit minutes of meeting to Owner, Project Inspector and Architect, for Project record purposes.
- E. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

#### **1.06 MATERIALS OWNERSHIP**

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain property of Mountain Area Regional Transit Authority, demolished materials shall become the Contractor's property and shall be removed, recycled, or disposed from Project site in an appropriate and legal manner.
  1. Arrange a meeting no less than ten (10) days prior to demolition with the Owner or Owner Representative and other designated representatives to review any salvageable items to determine if Owner wants to retain ownership, and discuss Contractor's Waste Management and Recycling Plan.
- B. Storage or sale of removed items or materials on-site will not be permitted without advance written approval from Owner Representative.

#### **1.07 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:

1. Vegetation to be protected.
2. Areas for temporary construction and field offices.
3. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
  1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
  2. Demolition firm qualifications.
- D. Demolition phase:
  1. Proposed dust-control measures.
  2. Proposed noise-control measures.
  3. Schedule of demolition activities indicating the following:
    - a. Detailed sequence of demolition and removal work, including start and end dates for each activity.
    - b. Dates for shutoff, capping, and continuation of utility services.
  4. If hazardous materials are encountered and disposed of, landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
  5. Contractor's Waste Management and Recycling Plan: See Section 01 74 19 - Construction Waste Management and Disposal.
    - a. This plan will not otherwise relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
  6. Contractor's Reuse, Recycling, and Disposal Report: See Section 01 74 19 - Construction Waste Management and Disposal.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.
  1. Record drawings: Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

#### **1.08 SUBMITTALS**

- A. Demolition and Removal Procedures and Schedule: Submit for Project record only.
- B. Project Record Drawings: Submit in accordance with provisions specified in Section 01 78 00 - Closeout Submittals. Indicate verified locations of underground utilities and storm drainage system on project record drawings.

#### **1.09 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
  1. Minimum of 5 years of documented experience.

#### **1.10 SCHEDULING**

- A. Schedule Work to precede new construction.
- B. Describe demolition removal procedures and schedule.

- C. Perform work between the hours of 8am and 5pm, subject to noise abatement regulations and Owner's approval for noise considerations.

## **PART 2 PRODUCTS -- NOT USED**

## **PART 3 EXECUTION**

### **3.01 DEMOLITION**

- A. Remove paving and curbs required to accomplish new work.
- B. Remove all other paving and curbs within construction limits indicated on drawings.
- C. Remove concrete slabs on grade within construction limits indicated on drawings.
- D. Remove fences and gates.
- E. Remove other items indicated, for salvage, relocation, and recycling.
- F. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Conform to the relevant Article of the General Conditions, South Coast Air Quality Management District and other applicable regulatory procedures when discovering hazardous or contaminated materials.
- B. Selective Demolition of Site and Building Elements:
  - 1. Use techniques acceptable to authorities having jurisdiction and which will achieve intended results and provide protection of surrounding features to remain.
  - 2. Some items may have been demolished prior to Work of this Contract. Verify existing conditions prior to start of demolition. If items are or have been demolished contact the Architect.
  - 3. Some items may require postponement of demolition until late in Contract Time period.
  - 4. Phase demolition as necessary to provide adequate interfacing of related Work.
  - 5. Demolish in an orderly and careful manner. Protect existing foundations, retaining walls, utility structures, other structures and finish materials to remain.
- C. Field Measurements and Conditions:
  - 1. Survey existing conditions and correlate with requirements indicated to determine extent of demolition and recycling required.
  - 2. In addition to provisions of the Conditions of the Contract, verify dimensions and field conditions prior to construction. Verify condition of substrate and adjoining Work before proceeding with demolition Work. If conflict is found notify Owner Representative, Project Inspector and Architect.
- D. Comply with requirements in Section 01 70 00.
- E. Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.

F. Environmental Controls

1. Comply with federal, state and local regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment and noise pollution.
2. Protection of Natural Resources: Preserve the natural resources within the project boundaries or restore to an equivalent condition.
3. Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.
4. Temporary Construction: Remove indications of temporary construction facilities, such as haul roads, work areas, structures, stockpiles or waste areas.
5. Water Resources: Comply with applicable regulations concerning the direct or indirect discharge of pollutants to underground and natural surface waters.
  - a. Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.
    - 1) Store and service construction equipment at areas designated for collection of oil wastes.
6. Dust Control, Air Pollution, and Odor Control: Prevent creation of dust, air pollution and odors.
  - a. Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
  - b. Store volatile liquids, including fuels and solvents, in closed containers.
  - c. Properly maintain equipment to reduce gaseous pollutant emissions.
7. Noise Control: Perform demolition operations to minimize noise.
  - a. Repetitive, high level impact noise will be permitted only during the times indicated in Section 01 70 00 - Execution and Closeout Requirements.

G. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Comply with applicable requirements of NFPA 241, CBC Ch. 33, and CFC Ch. 33.
3. Use of explosives is not permitted.
4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - a. Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
    - 1) Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.
  - b. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

- c. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.
- 5. Provide, erect, and maintain temporary barriers and security devices.
  - a. Provide, erect, and maintain temporary barriers, safety and security devices , for protection of streets, sidewalks, curbs, adjacent property and the public.
  - b. Protection: Protect existing construction and adjacent areas with temporary barriers and security devices in accordance with requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
    - 1) Review location and type of construction of temporary barriers with Owner and/or the Owner Representative.
    - 2) Barriers shall control dust, debris and provide protection for persons occupying and using adjacent facilities.
    - 3) Maintain protected egress and access at all times, in accordance with requirements of authorities having jurisdiction.
- 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
- 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
- 8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
- 9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
- 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- H. Do not begin removal until receipt of notification to proceed from Owner.
- I. Do not begin removal until built elements to be salvaged or relocated have been removed.
- J. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.
- K. Protect existing structures and other elements to remain in place and not removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
  - 4. Protect existing landscaping materials, appurtenances, structures and items that are not to be demolished, or are on adjacent property.
  - 5. Mark location of utilities.
- L. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- M. Hazardous Materials:
  - 1. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.



- N. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01 60 00 - Product Requirements.
- O. Perform demolition in a manner that maximizes salvage and recycling of materials.
  - 1. Comply with requirements of Section 01 74 19 - Construction Waste Management and Disposal.
  - 2. Dismantle existing construction and separate materials.
  - 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- P. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
- Q. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### **3.03 EXISTING UTILITIES**

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

### **3.04 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
  - 1. Verify construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
  - 1. Provide sound retardant partitions of construction and in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

- D. Remove existing work as indicated and required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
  - 2. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
  - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
  - 2. See Section 01 10 00 - Summary for limitations on outages and required notifications.
  - 3. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
  - 1. Prevent movement of structure. Provide shoring and bracing as required.
  - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch to match new work.

### **3.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove materials not to be reused on site; comply with requirements of Section 01 74 19 - Construction Waste Management and Disposal.
- C. Remove temporary work.
- D. Leave site in clean condition, ready for subsequent work.
- E. Clean up spillage and wind-blown debris from public and private lands.

### **END OF SECTION**

**SECTION 03 10 00**  
**CONCRETE FORMING AND ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.
- D. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.
- E. Section 05 31 00 - Steel Decking: Placement of steel anchors in composite decking.
- F. Section 05 50 00 - Metal Fabrications: Placement of embedded steel anchors and plates in cast-in-place concrete.
- G. Section 31 23 16 - Excavation: Shoring and underpinning for excavation.
- H. Section 32 13 13 - Site Concrete: Sidewalks, curbs and gutters.

**1.03 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
- B. ACI 301 - Specifications for Concrete Construction.
- C. ACI 318 - Building Code Requirements for Structural Concrete.
- D. ACI 347R - Guide to Formwork for Concrete.
- E. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- F. PS 1 - Structural Plywood.
- G. CBC Chapter 19A.

**1.04 DEFINITIONS**

- A. Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.
- B. Exposed Finish: A general-use finish applicable to all formed concrete exposed to view and including surfaces which may receive a paint coating (if any).

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide data on void form materials and installation requirements.
  - 1. Form release agent.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

#### **1.06 QUALITY ASSURANCE**

- A. Industry Standard: Formwork design and construction shall be in accordance with ACI 301, ACI 318, and ACI 347R.
- B. Maintain one copy of each installation standard on site throughout the duration of concrete work.
- C. Regulatory Requirements: Conform to formwork construction requirements of the California Building Code (CBC) Title 24, Part 2, Chapter 19A as amended and adopted by authorities having jurisdiction.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

### **PART 2 PRODUCTS**

#### **2.01 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Chamfer outside corners of beams, joists, columns, and walls.
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- E. Comply with relevant portions of ACI 301, ACI 318, and ACI 347R.
- F. Provide materials for contact with concrete which impart suitable surface quality to completed concrete. Use the following form types:
  - 1. Forms for Exposed Finish Concrete:
    - a. Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces.
    - b. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on the Drawings.
  - 2. Forms for Unexposed Finish Concrete:
    - a. Plywood, lumber, metal, or another acceptable material.
    - b. Provide lumber dressed on at least two edges and one side for tight fit.

- c. When unexposed concrete is intended to receive waterproofing, provide form as for exposed finish concrete.
- G. Provide materials to construct formwork to support forming materials in contact with concrete, of sufficient capacity to withstand pressures of concrete placement and to support concrete in place until cured, without distortion.

## **2.02 WOOD FORM MATERIALS**

- A. Plywood for Architectural Concrete: Marine Grade, APA B-B Plyform Class 1.
  - 1. APA proprietary concrete form panels designed for high reuse.
  - 2. HDO for very smooth concrete finish, in Structural I, and with special overlays.
  - 3. Bond Classification: Exterior. Common Performance Categories: 19/32, 5/8, 11/16, 23/32, 3/4.
- B. Softwood Plywood for Concealed Surfaces: PS 1, undamaged face C Grade, Group 2 Plugged EXT or APA Structural I Sheathing.
- C. Hardboard: For curved surfaces, tempered hardboard, Masonite Corp., or equal.
- D. Lumber: Douglas fir or douglas fir-larch species; appropriate for intended use grade; with grade stamp clearly visible.
  - 1. Sound and undamaged straight edges, and solid knots, to maintain principal shores to support concrete until minimum strength is achieved as approved by Structural Engineer.
- E. Embedded Nailers: Clear all heart redwood or pressure preservative-treated (PPTDF) douglas fir, edges reverse beveled to key into concrete.

## **2.03 FORMWORK ACCESSORIES**

- A. Form Ties: Removable, adjustable-length or snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
  - 1. Do not use materials containing diesel oil or petroleum-based compounds.
  - 2. Does not impair subsequent treatments of concrete surfaces or bond of applied coatings.
  - 3. Products:
    - a. Nox-Crete Inc; BIO-NOX: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
    - b. SpecChem, LLC; Bio Strip WB (water-based): [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - c. W. R. Meadows, Inc; Duogard II (water-based): [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.
  - 1. Thickness: 0.125 inch
  - 2. Compression Resistance, ASTM D695: 5,500-8,000 PSI.

- 3. Products:
  - a. BoMetals, Inc: [www.bometals.com/#sle](http://www.bometals.com/#sle).
  - b. Sika Corporation; Speed Dowel: [usa.sika.com](http://usa.sika.com)
  - c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 50 00.
- F. Screed Pins and Chairs:
  - 1. Provide units that leave no metal closer than 1-1/2 inch to the plane of the exposed concrete surface.
  - 2. Manufacturers:
    - a. Grann Adjustable Quick Screed (800/554-7266).
    - b. Dayton Richmond (800/745-3700).
    - c. Aztek (877/531-3344).
    - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

#### **3.02 SYSTEM REQUIREMENTS**

- A. Formwork Design Requirements: Formwork products and execution specified herein are for finish surface quality only.
  - 1. Design, layout and construction of formwork shall be solely the responsibility of the Contractor.
  - 2. Design and construct formwork, shoring and bracing to conform to California Building Code (CBC), Title 24, Part 2, Chapter 19A requirements and ACI 318.
  - 3. Resulting concrete shall conform to shapes, lines and dimensions indicated and required.
- B. Coordination:
  - 1. Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses.
  - 2. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from the Architect before proceeding.

#### **3.03 EARTH FORMS**

- A. Earth (Soil) Forms, General: Except as otherwise indicated on Drawings, conform to ACI 301, ACI 347R and California Building Code (CBC) requirements. Refer also to notes on Structural Drawings.
- B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

### 3.04 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301, ACI 347R and California Building Code (CBC) Title 24, Part 2 requirements.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
  - 1. Use form ties of sufficient strength and sufficient quantities to prevent formwork spreading.
  - 2. Maintain principal shores to support concrete until minimum required strength is achieved.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
  - 1. Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work.
  - 2. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.
- D. Align joints and make watertight. Keep form joints to a minimum. Make forms watertight to prevent leakage of concrete mortar. Locate form joints, at exposed concrete, to be symmetrical about center of panel, unless otherwise noted. Align joints symmetrically at exposed conditions.
- E. Permanent openings: Provide openings to accommodate Work specified in other Sections. Size and locate openings accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.
- F. Temporary openings: Provide temporary openings for cleaning and inspection. Provide drain openings at bottoms of formwork to allow water to drain. Locate temporary openings in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete Work.
- G. Obtain approval before framing openings in structural members that are not indicated on drawings.
- H. Coordinate this section with other sections of work that require attachment of components to formwork.
- I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.
- J. Inspection: Before placing of concrete, and after placement of reinforcing steel in the forms, provide notification so that proper inspection can be made. Make such notification at least 2 working days in advance of placing concrete.
- K. Rejection of Defective Work: Any movement or bellying of forms during construction or variations in excess of the tolerances specified shall be considered just cause for the removal of such forms and, in addition, the concrete construction so affected. Reconstruct forms, place new concrete and required reinforcing steel at no additional cost to the Owner.

### **3.05 APPLICATION - FORM RELEASE AGENT**

- A. Form Release Agent: Provide either form materials with factory applied non-absorptive liner or field applied form coating to comply with applicable air quality regulations for VOC. If field applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use. Rust on form surfaces is not acceptable.
- B. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- C. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- D. Do not apply form release agent where concrete surfaces to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

### **3.06 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
  - 1. Install accessories in accordance with manufacturer's instructions and referenced standards, level, straight and plumb.
- B. Locate and set in place items that are cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
  - 1. Openings: Size and locate formed openings, depressions, recesses and chases to accommodate products to be applied to, built into and pass through concrete Work. Coordinate size, location and placement of inserts, embedded products, openings and recesses with Work specified in other Sections.
  - 2. Anchors and Other Devices: Set and build into concrete formwork anchorage devices and other embedded products required for Work to be attached to or supported by concrete elements.
  - 3. Locating Embedded Products and Openings: Use setting drawings, diagrams, instructions and templates to set embedded products.
  - 4. Screeds: Set screeds and establish level for tops of concrete slabs and leveling for finish surfaces. Shape surfaces as indicated on the Drawings. Provide cradle, pad or base type screed supports for concrete over waterproof membranes and vapor retarders.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints are not apparent in exposed concrete surfaces.

### **3.07 FORM CLEANING**

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.



1. At above grade forms, flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
  2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.
- C. Formwork Reuse: Do not reuse wood and plywood forming materials which contact concrete, except as follows:
1. High density plywood may be cleaned and reused for exposed concrete.
  2. Unfaced plywood may be reused for concealed concrete.
  3. Steel and fiberglass forming materials may be cleaned and reused.
- D. Patching and Repairs: Patch tie holes with sheet metal patches and restore forms to like new condition prior to reuse.

### **3.08 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
1. Also as specified in ACI 301, ACI 318, and ACI 347R, unless otherwise specified or indicated.
- B. Camber slabs and beams in accordance with ACI 301.

### **3.09 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
1. Comply with CBC Table 1705A.3, item 12.
- C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

### **3.10 FORM REMOVAL**

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
1. Comply with California Building Code (CBC) requirements.
  2. Formwork supporting weight of concrete may not be removed until concrete has reached a minimum of specified 28-day compressive strength and no earlier than 21 days after pour.
  3. Removal of Load Bearing Formwork:
    - a. Do not remove shoring and forms supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, until concrete has attained its 28 day specified compressive strength, unless otherwise specified or permitted by the Structural Engineer of Record.

- b. Determine the actual compressive strength has attained is adequate to support the weight of the concrete and superimposed loads.
  - c. Maintain curing and protection operations after form removal.
- 4. Removal of Non Load Bearing Formwork After Superimposed Loads or as Approved by Engineer:
  - a. Provided that concrete has hardened sufficiently, that it is not damaged, and has achieved sufficient strength to support its own weight and all imposed construction and design loads, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours.
  - b. Maintain curing and protection operations after form removal.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
  - 1. Remove formwork progressively so no unbalanced loads are imposed on structure. Remove formwork without damaging concrete surfaces.
  - 2. Remove or snap off metal spreader ties inside wall surface. Cut nails and form ties off flush and leave surfaces level and clean.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

### **3.11 PATCHING**

- A. Schedule: Patch forming and tie holes immediately after form removal.
- B. Cleaning: Clean surface of all loose materials and soiling.
- C. Patching: Patch all holes and depressions with grouting gun and grout mix of one part cement and 2-1/2 parts mortar sand.

### **3.12 FORMWORK SCHEDULE**

- A. Footings and Walls, Not Exposed to View: Site fabricated plywood or lumber, coated with form release agent.
- B. Footings and Walls, Exposed to View: Site fabricated plywood, coated with form release agent compatible with applied finish coatings.

**END OF SECTION**

## **SECTION 03 20 00 CONCRETE REINFORCING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Division 26 - Electrical: Grounding connection to concrete reinforcement.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Concrete Construction.
- B. ACI 318 - Building Code Requirements for Structural Concrete.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- D. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
- E. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- H. AWS A5.5/A5.5M - Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.
- I. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.
- J. CRSI (DA4) - Manual of Standard Practice.
- K. CRSI (P1) - Placing Reinforcing Bars, 10th Edition.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Reinforcement supporting and spacing devices at exposed concrete only, to demonstrate non-corroding and non-staining characteristics.
  - 2. Adhesive compounds.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Reports: Submit certified copies of mill test report of reinforcement materials analysis.
- F. Quality Control Submittals: Submit the following information related to quality assurance requirements specified:
  - 1. Certifications: Submit to the testing laboratory mill test certificates for all reinforcing steel, showing physical and chemical analysis. If steel is to be welded, include in chemical analysis the percentages of carbon, manganese, copper, nickel, and chromium, and optionally the percentages of molybdenum and vanadium.
  - 2. Certifications: If steel is to be welded, submit certifications to the testing laboratory signed by AWS Certified Welding Inspector (CWI) of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualification of welding operators, and qualification of welders.
- G. Welding Procedure Specification Submittal: Submit to Testing Laboratory written Welding Procedure Specifications (WPS) as defined by AWS D1.4/D1.4M. The WPS shall be prepared by the Fabricator for review and approval by the Architect (Structural Engineer) and Testing Laboratory as complying with specified criteria, and shall be readily available to the welding inspector.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 318, CRSI (DA4), CRSI (P1), ACI 301, ACI 318, CRSI (DA4), and CRSI (P1).
  - 1. Maintain one copy of each document on project site.
- B. Regulatory Requirements: Conform to California Building Code (CBC) Title 24 Part 2, Chapter 19A requirements as amended and adopted by authorities having jurisdiction, for details of reinforcement.
- C. Provide Architect, Project Inspector, and Special Inspector with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.
  - 1. Only AWS Certified Welding Inspectors shall be used for tests and qualifications associated with welding of reinforcing steel.
  - 2. Only AWS qualified welders or welding operators shall perform welding of reinforcing steel.
- E. Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses.
- F. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect (Structural Engineer) before proceeding.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Delivery: Deliver reinforcement bars new and free from rust and mill scale in original bundles marked with durable identification tags.

- B. Storage: Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening coatings.
- C. Handling: Take precautions to maintain reinforcement identification after bundles are broken.

## **PART 2 PRODUCTS**

### **2.01 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
  - 1. Deformed billet-steel bars.
  - 2. Unfinished.
- B. Reinforcing Steel: ASTM A706/A706M, Grade 60 (60,000 psi), deformed low-alloy steel bars.
  - 1. Unfinished.
  - 2. Carbon Content: 0.55 % maximum.
- C. Reinforcing Steel: #3 Deformed bars, ASTM A615/A615M Grade 40 (280), Type A.
- D. Tie Wire: ASTM A1064/A1064M steel wire, unfinished.
- E. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
  - 2. Chairs, Bolsters, Bar Supports, Spacers: Wire-bar-type devices, complying with CRSI (DA4), for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Sized and shaped for adequate support of reinforcement during concrete placement.
    - a. Supports at Slab on Grade: Provide devices with load-bearing pads or horizontal runners where base material does not support chair legs, to prevent puncture of vapor retarder/barrier or provide precast concrete block bar supports of equal or greater strength to specified concrete.
    - b. Corrosion Resistance:
      - 1) Provide stainless steel or plastic components for placement within 1-1/2 inches of weathering surfaces.
        - (a) Provide plastic coated, plastic-tipped (CRSI, Class 1) or stainless steel types at exposed-to-view concrete surfaces.
        - (b) Provide only stainless steel (CRSI Class 2) at exterior exposed surfaces to be painted.
  - 3. Welding Electrodes: AWS A5.5/A5.5M E80XX, low hydrogen, with a minimum yield point of 80,000 psi, for welding grade 60 reinforcing steel.

### **2.02 RE-BAR SPLICING:**

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing 160% of steel reinforcing design strength in tension and compression.
- B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; Type II capable of developing 160% of steel reinforcing design strength in tension and compression.

- C. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

## **2.03 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.
- C. Fusion welded reinforcing steel assemblies are not permitted.
- D. Locate reinforcing splices not indicated on drawings at point of minimum stress. See Structural Drawings,
  - 1. Review locations of splices with Architect (Structural Engineer) before fabrication and placement. .

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Cleaning: Clean reinforcement to remove loose rust and mill scale, soil, and other materials which may reduce or destroy bond with concrete.
- B. Adjustment and Inspection: Do not bend or straighten reinforcement in a manner injurious to material. Do not use bars with kinks or bends not shown on Drawings and reviewed shop drawings, or bars with reduced cross-section due to corrosion or other cause.
- C. Do not bend bars No. 5 and larger in the field.
- D. Do not bend bars more than once in the same location.

### **3.02 PLACEMENT**

- A. General: Place and secure reinforcement as specified herein, as indicated and noted on Drawings and in compliance with recommended details and methods of reinforcement placement and support specified in CRSI Placing Reinforcing Bars.
- B. Place, support and secure reinforcement against displacement. Do not deviate from required position.
  - 1. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- C. Do not displace or damage vapor barrier.
- D. Accommodate placement of formed openings.
- E. Maintain concrete cover around reinforcing as indicated on Structural Drawings:
- F. Comply with applicable code for concrete cover over reinforcement.
  - 1. If not otherwise indicated on Drawings or specified herein, provide concrete cover in compliance with ACI 318.
- G. Bond and ground all reinforcement to requirements of Division 26.
- H. Coordination: Locate reinforcement to accommodate embedded products and formed openings and recesses.

- I. Slab on Grade Reinforcement: Do not displace or damage vapor retarder/barrier at slab on grade.
- J. Wire Reinforcement Placement: Place reinforcement in sheets as long as practicable, lapping adjoining pieces at least one full mesh and lace splices with 16 gage wire. Offset end laps in adjacent widths to prevent continuous laps. Extend reinforcement to within 1-inch of edge at slabs on grade. Cut mesh at expansion joints and full depth control joints.
- K. Dowels: Secure tie dowels in place before depositing concrete. Provide No. 3 bars for securing dowels where no other reinforcement is provided.
- L. Reinforcement Splices, General: Provide standard reinforcement splices by lapping ends, placing bars in contact and tightly wire tying. Comply with details and requirements of ACI 318 for minimum lap of spliced bars and criteria indicated on the Drawings.
  - 1. Clearances for Splices: Wherever possible, provide minimum 1-1/2 inch clearance between sets of splices. Stagger horizontal bars so that adjacent splices are minimum 48 inches apart.
- M. Reinforcement Supports: Support reinforcement on metal chairs, spacers or metal hangers to provide required coverage and to properly locate reinforcement. Do not use wood. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
  - 1. Support Spacing: Space chairs and accessories in conformance with CRSI Placing Reinforcing Bars.
- N. Welding of Reinforcement Steel
  - 1. Welding: Perform welding under continuous inspection and supervision of a qualified Registered Deputy Inspector employed by testing and inspection agency. Weld reinforcement as indicated on Drawings.
  - 2. If mill test report is not available, make chemical analysis of bars representative of bars to be welded. Bars with CE above 0.75 shall not be welded.
  - 3. No welds shall be made at bends in reinforcing bars. Welds to be 1 inch minimum from bends
- O. Corrections During Concrete Placement: Maintain reinforcing steel workers on-site during placement of concrete for resetting reinforcement displaced by runways, workers and other causes.

### **3.03 FIELD QUALITY CONTROL**

- A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.
  - 1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.
- B. Inspector of Record, as specified in Section 01 45 33 - Code-Required Special Inspections, will inspect installed reinforcement for conformance to contract documents before concrete placement.
  - 1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.

- C. Defective Reinforcement Work: The following shall be considered defective and may be ordered to be removed and reconstructed at no change in Contract Time or Sum.
1. Bars with kinks or bends not shown on Drawings.
  2. Bars injured due to bending or straightening.
  3. Bars heated or bent.
  4. Reinforcement not placed in accordance with Drawings and Specifications.
  5. Rusty or oily bars.
  6. Bars exposed in surface of concrete or without adequate concrete cover.

**END OF SECTION**



**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Floors and slabs on grade.
- B. Joint devices associated with concrete work.
- C. Miscellaneous concrete elements, including equipment pads and thrust blocks.
- D. Concrete curing.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.
- D. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- E. Section 32 13 13 - Site Concrete: Sidewalks, curbs and gutters.

**1.03 REFERENCE STANDARDS**

- A. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
- B. ACI 301 - Specifications for Concrete Construction.
- C. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
- D. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- F. ACI 305R - Guide to Hot Weather Concreting.
- G. ACI 306R - Guide to Cold Weather Concreting.
- H. ACI 308R - Guide to External Curing of Concrete.
- I. ACI 318 - Building Code Requirements for Structural Concrete.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- M. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens).
- N. ASTM C111/C111M - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
- O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

- P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
- Q. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- R. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- S. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
- T. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- U. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
- V. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- W. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- X. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
- Y. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- Z. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- AA. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
- BB. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- CC. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- DD. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- EE. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- FF. CBC - California Building Code.
- GG. DSA IR 19-3 - Fly Ash and Natural Pozzolans Used in Concrete.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
  - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- C. Mix Design: Submit proposed concrete mix design.
  - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 19 - Concrete: Design and Durability Requirements, and Chapter 26 - Construction Documents and Inspection.
  - a. Reports must include all the data as required to verify conformance with ACI 318, Section 26.4.2.2, and the following:
    - 1) Mix design identification number.
    - 2) Cement certification.
    - 3) Fly ash certification of compliance or test data.
    - 4) Admixture data.
    - 5) Aggregate test data.
3. Mix Designs Utilizing 15% Or More Fly Ash: Proportioning shall be based on field experience or trial mixtures, or both, per ACI 318, Section 26.4. Proportioning per ACI 318, Section 26.4.2.2 (without field experience or trial mixtures) is not permitted.
4. Mix Design Review and Approval Process: An engineer from a DSA approved (LEA) testing laboratory shall review the mix design report and the design professional in responsible charge of the project shall approve the mix design.
  - a. Review by LEA Engineer: A qualified civil engineer associated with a DSA approved (LEA) testing laboratory shall review the report for conformance with ACI 318, Sections 26.4.2.2. Issue an evaluation report of findings and recommendation for either acceptance or rejection and forward his report to the design professional in responsible charge of the project.
  - b. Approval by the Project Engineer in Responsible Charge: Based on the findings and recommendation of the LEA engineer's evaluation report, the project design professional in responsible charge decides whether to accept or reject the mix design. He will issue a letter stating his acceptance or rejection. The letter shall be sent to DSA, and copied to the project inspector, the LEA laboratory, and the mix design engineer.
  - c. Documentation by the Concrete Supplier: The concrete supplier shall submit copies of the cement certification, fly ash certification of compliance or test data, admixture data, aggregate test data, and mix design identification number to the project inspector and the LEA engineer who reviewed the mix design report.
5. Indicate proposed mix design complies with admixture manufacturer's written recommendations.
6. Mix Design: Submit mix designs prepared, stamped and signed by a Civil Engineer licensed in the State of California.
- D. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
- E. Verification Samples: Submit sample chips of specified colors indicating pigment numbers and required dosage rates, for subsequent comparison to installed concrete.
- F. Samples: Submit samples of underslab vapor retarder to be used.
- G. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.
- H. Quality Control Submittals:

1. Field tests: Submit reports of all slump, strength and air content tests as required by authorities having jurisdiction and as indicated on the Drawings and specified herein.
  2. Delivery tickets: Have available copies of delivery tickets complying with ASTM C94/C94M for each load of concrete delivered to site. Include on the tickets the additional information specified in the ASTM document.
- I. Test Reports: Submit report for each test or series of tests specified.
  - J. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
  - K. Sustainable Design Submittals: If any wood or wood-based form materials, including supports, are permanently installed in the project, submit documentation required for sustainably harvested wood as specified in Section 01 60 00 - Product Requirements.
  - L. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.
  - M. Sustainable Design Submittal: Submit environmental assessment report for concrete mix. Compare concrete mix submitted with a conventional or reference concrete mixture that meets the specified performance requirements. Include:
    1. Energy consumption.
    2. Emissions.
    3. Potential toxicity.
    4. Potential risk.
    5. Raw material consumption.
    6. Land use.
    7. Third-party validation of comparison methodology.
  - N. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
  - O. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## **1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
  1. Maintain one copy of each document on site.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.
- E. Regulatory Requirements:
  1. Conform to California Building Code (CBC) Chapter 19A requirement, as amended and adopted by authorities having jurisdiction.

2. Chemical products field-applied to concrete shall comply with applicable air quality requirements of authorities having jurisdiction.
  - a. Comply with Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions, CALGreen Section 5.504.4 Finish material pollutant control; 5.504.4.1 Adhesives, sealants and caulks; 5.504.4.3 Paints and coatings.
  - b. Comply with CALGreen Section A5.405.4 Recycled content.
  - c. Comply with CALGreen Section A5.406 Enhanced Durability and Reduced Maintenance.
- F. Testing Agency Services: District will engage an independent testing and inspection agency to conduct tests and perform other services specified for quality control during construction, as required by Section(s) 01 40 00 - Quality Requirements and 01 45 33 - Code-Required Special Inspections.
- G. Coordination: Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories. Coordinate concrete requirements with Work specified for underground utilities and mechanical and electrical equipment pads and bases.

#### **1.06 MOCK-UP**

- A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
  1. Panel Size: Sufficient to illustrate full range of treatment.
  2. Number of Panels: Two.
  3. Locate as indicated on drawings.
- B. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
- C. Mock-up may not remain as part of the Work.

#### **1.07 DELIVERY AND HANDLING**

- A. Protection During Concrete Placement: Provide protective coverings and runways, and use appropriate equipment and means of access to Work areas to avoid soiling or damage to existing conditions.
- B. Runoff: Prevent run off of water contaminated by construction agents and chemicals from soiling existing surfaces and from contaminating existing and future landscape areas.

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Slabs with Porosity Inhibiting Admixture (PIA) or Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.
  1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
  2. Provide warranty by admixture manufacturer matching terms of flooring adhesive or primer manufacturer's material defect warranty.

- C. Moisture Emission-Reducing Curing and Sealing Compound, Penetrating: Provide non-prorated warranty to cover cost of flooring delamination failures for 20 years.
  - 1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.
  - 2. See Section 09 05 61 - Common Work Results for Flooring Preparation.

## **PART 2 PRODUCTS**

### **2.01 FORMWORK**

- A. Comply with requirements of Section 03 10 00.

### **2.02 REINFORCEMENT MATERIALS**

- A. Comply with requirements of Section 03 20 00.

### **2.03 CONCRETE MATERIALS**

- A. Recycle Requirements: Concrete fly ash or other pozzolanic materials where total recycled content is equal to post consumer content plus half of secondary recycled content, but not to exceed recommended code guidelines.
  - 1. Maximum percent to comply with ACI 318 Table 26.4.2.2 (h) and section 19.3.3.4.
  - 2. Recycled materials percentage of pre-consumer and post-consumer recycled content per shall be as noted below:
    - a. 25% Post-Industrial or Pre-Consumer, (by rule this is reduced by one-half.)
    - b. 12.5% Post-Consumer,
    - c. Total 25%
- B. Cement: ASTM C150/C150M, Type II - Moderate Portland type.
  - 1. Cement used in contact with soil shall be Type V - Sulfate Resistant.
  - 2. Acquire cement for entire project from same source.
- C. Fine and Coarse Aggregates: ASTM C33/C33M.
  - 1. Acquire aggregates for entire project from same source.
  - 2. Fine and coarse aggregates, CBC Title 24, Part 2, 1903A.5, ACI 318 Section 26.4.
  - 3. Concrete indicated to receive abrasive blast or retarded finish: Design mix with uniform fine to coarse gradation of aggregates to produce evenly textured finish surface.
  - 4. Other than Structural Concrete: Conform to requirements for structural concrete.
- D. Fly ash and raw or calcined natural pozzolans to conform to ASTM C618 for Class N or F (Class C fly ash is not permitted). Per ASTM C618, sampling and testing of fly ash in accordance with ASTM C111/C111M.
  - 1. Comply with DSA IR 19-3 for the use of fly ash or natural pozzolan.
  - 2. Fly Ash: ASTM C618, Class N or F.
    - a. Supply fly ash by an experienced producer that complies with all applicable standards above.

- b. Provide fly ash from one source for the duration of the project, unless additional physical testing of the changed mix is performed; per Concrete Mix Design.
- 3. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

## 2.04 ADMIXTURES

- A. The use of any chemical admixture is subject to prior approval by DSA.
- B. Use no admixtures not included in mix design. Products of the following manufacturers are specified and will be acceptable provided they comply with referenced standards all other requirements of the Contract Documents:
- C. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- D. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
  - 1. Products:
    - a. Euclid Chemical Company; ACCELGUARD 80: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
  - 1. Provide pigmented type, with ASTM C979/C979M inorganic pigments.
- F. Water Reducing Admixture: ASTM C494/C494M Type A.
  - 1. Products:
    - a. Euclid Chemical Company; EUCON NW: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- G. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs). Closes capillary systems formed during concrete curing to reduce moisture vapor emission and transmission. Reduces concrete shrinkage with no adverse effect on concrete properties or applied flooring.
  - 1. Provide admixture in slabs to receive adhesively applied flooring or roofing.
  - 2. Provide admixture in concrete for elevator pits, retaining walls, water-retaining structures, underground structures, roads, dams, and bridges.
  - 3. VOC Content: Zero.
  - 4. Installed admixture to meet or exceed Modified ASTM F1869 or ASTM F2170 testing to performance of moisture vapor emission rate (MVER) of 4 lbs/1,000 ft<sup>2</sup>/24 hours or lower.
    - a. Alternative test methods shall be acceptable to the finish flooring manufacturer and installer.
  - 5. The concrete ready mix supplier must coordinate with the admixture manufacturer before designing and testing any new mix designs, to receive guidance on achieving proper water absorption characteristics.
  - 6. Products:

- a. AVECS, LLC; PRO-ACT: [www.avecs.build/#sle](http://www.avecs.build/#sle).
- b. Barrier One Concrete Admixtures; MVRA-CPS: [www.barrierone.com/#sle](http://www.barrierone.com/#sle).
- c. Hycrete, Inc: [www.hycrete.com/#sle](http://www.hycrete.com/#sle).
- d. ISE Logik Industries, Inc; MVRA 900: [www.iselogik.com/#sle](http://www.iselogik.com/#sle).
- e. Specialty Products Group; Vapor Lock 20/20: [www.spggogreen.com/#sle](http://www.spggogreen.com/#sle).
- f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## 2.05 ACCESSORY MATERIALS

### A. Underslab Vapor Retarder:

- 1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
- 2. Performance Requirements:
  - a. Comply with ACI 302.1R and ACI 302.2R.
  - b. Water Vapor Permeance: Not more than 0.010 perms, maximum.
    - 1) Permeance as tested after conditioning (ASTM E1745).
  - c. Comply with ASTM E1745 Class A.
  - d. Puncture Resistance, ASTM D1709: 2,300 gms.
- 3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
- 4. Products:
  - a. Henry Company; Moistop Ultra 15: [www.henry.com/#sle](http://www.henry.com/#sle).
  - b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): [www.isibp.com/#sle](http://www.isibp.com/#sle).
  - c. Raven Industries; VaporBlock VB15, 15 mils thick (0.01 perms), Class A, unreinforced polyolefin: [ravenefd.com](http://ravenefd.com),
  - d. Reef Industries, Inc.; Vaporguard, 15 mil (E-96 0.000 perms), Class B: [www.reefindustries.com](http://www.reefindustries.com)
  - e. Stego Industries, LLC; Stego Wrap Vapor Barrier, 15 mils:: [www.stegoindustries.com/#sle](http://www.stegoindustries.com/#sle).
  - f. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
  - g. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

- 1. Grout: Comply with ASTM C1107/C1107M.
- 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
  - a. Maximum: Plus 4 percent.
  - b. Minimum: Plus 1 percent.
- 3. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.



4. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
5. Products containing aluminum powder are not permitted.
6. Flowable Products:
  - a. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
  - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; DURAGROUT: [www.laticrete.com/our-products/concrete-construction-chemicals/#sle](http://www.laticrete.com/our-products/concrete-construction-chemicals/#sle).
  - c. SpecChem, LLC; SC Precision Grout: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
  - d. W. R. Meadows, Inc; 588-10K: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
  - e. W. R. Meadows, Inc; 1428 HP: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
  - f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
7. Low-Slump, Dry Pack Products:
  - a. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
  - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Duragrout: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
  - c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## **2.06 BONDING AND JOINTING PRODUCTS**

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
  1. Products:
    - a. Euclid Chemical Company; AKKRO-7T: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. SpecChem, LLC; Strong Bond Acrylic Bonder: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - c. W. R. Meadows, Inc; ACRY-LOK-: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Epoxy Bonding System:
  1. Complying with ASTM C881/C881M and of Type required for specific application.
  2. Products:
    - a. Adhesives Technology Corporation: [www.atcepoxy.com/#sle](http://www.atcepoxy.com/#sle).
    - b. Euclid Chemical Company; DURAL FAST SET LV: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. Euclid Chemical Company; DURALFLEX GEL: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - d. Euclid Chemical Company; DURALFLEX LV: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - e. Euclid Chemical Company; DURAL 452 GEL, DURAL 452 LV, or DURAL 452 MV: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - f. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - g. SpecChem, LLC; SpecPoxxy 1000, SpecPoxxy 2000, SpecPoxxy 3000, or SpecPoxxy 3000FS: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - h. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).

- i. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
  - 1. Material: Closed-cell, non-absorbent, compressible polymer foam in sheet form.
  - 2. Products:
    - a. W. R. Meadows, Inc; Deck-O-Foam Joint Filler with pre-scored top strip: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
  - 1. Products:
    - a. W. R. Meadows, Inc; Speed-E-Joint: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.
  - 1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
  - 2. Height: To suit slab thickness.
- F. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

## 2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
  - 1. Products:
    - a. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Euclid Chemical Company ; EUCOBAR: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. Nox-Crete Inc; Monofilm: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
    - d. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - e. W. R. Meadows, Inc ; Evapre or Evapre-RTU: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
  - 1. Product dissipates within 4 to 6 weeks.
  - 2. Provide product containing fugitive red dye.
  - 3. Products:
    - a. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).

- b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
  - c. W. R. Meadows, Inc; 1100-Clear: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
  - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- C. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Clear, liquid sealer for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
- D. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
  - 1. Solids by Mass: 25 percent, minimum.
  - 2. VOC Content: OTC compliant.
  - 3. Products:
    - a. Euclid Chemical Company; DIAMOND CLEAR VOX: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. W. R. Meadows, Inc; CS-309-25 OTC: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- E. Curing and Sealing Compound, High Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
  - 1. Application: Use at \_\_\_\_.
  - 2. Vehicle: Solvent-based.
  - 3. Solids by Mass: 25 percent, minimum.
  - 4. Products:
    - a. SpecChem, LLC; Cure and Seal WB 30: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - b. W. R. Meadows, Inc; VOCOMP-30: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- F. Moisture-Retaining Sheet: ASTM C171.
  - 1. Curing paper, regular.
  - 2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
- G. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.
- H. Water: Potable, not detrimental to concrete.

## **2.08 CONCRETE MIX DESIGN**

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations and ACI 318.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
  - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
  - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  - 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
  - 4. Water-Cement Ratio: As indicated on Structural Drawings.
  - 5. Maximum Slump: As indicated on Structural Drawings.
  - 6. Maximum Aggregate Size: 1 inch.
    - a. Structural Concrete: Maximum size not larger than 1/5 of narrowest dimension between forms, 1/3 depth of slab nor 3/4 of minimum clear spacing between individual reinforcing bars.
    - b. Other than Structural Concrete: Conform to requirements for structural concrete.

## **2.09 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.
- C. Do not use shrinkage-reducing admixture (SRA) in same concrete batch with MVRA or PIA.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this section.
- B. Layout construction and control joints according to the drawing details and plans following these guidelines:
  - 1. Finished exposed concrete floors are critical for aesthetics.
  - 2. Layout joints on exposed concrete floors to allow for installation of utilities without sawcutting or concrete placement of different production batches subject to different colors. Staining and integral color concrete is not exempt from this requirement.
  - 3. Architect to review joint pattern submittal each floor.
  - 4. No lengthwise joints in corridors; place cross-corridor, if required.
  - 5. Place joint at 90 degree wall corners.
  - 6. Place joints at center line of columns.
  - 7. Equally space all joints.
- C. Verify that concrete cover requirements are met in formwork construction and reinforcement placement.

- D. Examine areas to receive reinforced vapor retarders. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.
- E. Subbase: Per ACI 302.1R.
  - 1. As indicated on Drawings and approved by the Geotechnical Engineer.
    - a. Minimum 4 inch thick (or larger) base of 1/2 inch or larger clean aggregate, per CA Green Code 4.505.2.1 and CBC 1907.1A.
- F. Verify that base material (sand, gravel or natural as specified or indicated on Drawings) level, vapor barrier/retarder properly placed and that required clearances to reinforcing steel have been maintained.
- G. Verify that all embedded products and formed openings and recesses are correctly placed.
- H. At slabs on grade, verify that vapor retarder/barrier is properly placed and free of damage.

### **3.02 PREPARATION**

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Prepare previously placed concrete by cleaning with hydro-blasting or wet sand blasting to provide suitable surface for bonding. Provide minimum aggregate exposure of 1/4 inch.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
  - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
  - 2. Use latex bonding agent only for non-load-bearing applications.
- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
  - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
    - a. Install total thickness indicated on Drawings. Provide crushed rock, 1/2 inch grading, clean washed, complying with ASTM C33/C33M.
    - b. Minimum 4 inch thick (or larger) base of 1/2 inch or larger clean aggregate, per CA Green Code 4.505.2.1 and CBC 1907.1A.
    - c. Seam and Lap Sealing: With adhesive mastic and adhesive sealing tape, seal all seams, edges and penetrations of vapor retarder/barrier.
      - 1) For adhesive mastic seal, apply adhesive to both surfaces, allow approximately 10 minutes to set up and then press together smoothly and evenly, without gaps or fishmouths, for full contact bond.
      - 2) For adhesive tape seal, comply with manufacturer's instructions and recommendations.

- 3) Seal all penetrations with both adhesive sealing tape and adhesive mastic.
  - 4) Seal sheets to concrete footing faces and penetrating components with adhesive mastic or double sided tape as recommended by membrane manufacturer.
2. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

### **3.03 CONCRETE MIXING**

- A. Concrete Mixing, General: Comply with ACI 318 as adopted by CBC, Title 24, Part 2, Chapter 19A and ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete. Introduce and mix admixtures in compliance with manufacturer's instructions and recommendations.

### **3.04 PLACING CONCRETE**

- A. Notify Owner's Inspector and at least 2 working days in advance of placing concrete.
- B. Place concrete in accordance with ACI 304R.
  1. General: Comply with ACI 318 as adopted by CBC, Title 24, Part 2, Chapter 19A and as follows:
    - a. Schedule continuous placement of concrete to prevent the formation of cold joints.
    - b. Deliver ready mix concrete in accordance with ASTM C94/C94M. Place concrete within 90 minutes after start of mixing.
    - c. Provide construction joints if concrete for a particular element or component cannot be placed in a continuous operation.
      - 1) Submit for review, proposed locations of joints prior to pouring. See Structural Drawings for additional requirements.
    - d. Deposit concrete as close as possible to its final location, to avoid segregation.
  2. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
    - a. Consolidate concrete by means of mechanical vibrators, inserted vertically in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
    - b. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
    - c. Do not use vibrators to move concrete laterally.
- C. Hot Weather Placement: Comply with recommendations of ACI 305R when ambient temperature before, during, or after concrete placement is expected to exceed 90 deg F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 lbs./SF/Hr..
  1. Use evaporation reducer.
  2. Do not add water to approved concrete mixes under any conditions.

3. Provide mixing water at lowest feasible temperature, and provide adequate protection of poured concrete to reduce rate of evaporation.
  4. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.
- D. Cold-Weather Placement: Comply with provisions of ACI 306R when air temperature has fallen to or is expected to fall below 40 deg F. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. Uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- E. Place concrete for floor slabs in accordance with ACI 302.1R.
1. Schedule continuous placement and consolidation of concrete within planned construction joints.
  2. Place concrete in linear pattern, with control joints at slab on grade conditions only, with joints located as indicated on the Drawings.
  3. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds or vibrating laser screed as described below.
  4. Screeding Procedures: Strike off and level concrete slab surfaces before bleed water can collect on surface. Do not work concrete further until finishing operations are commenced.
    - a. Typical Slabs: Strike off and level surface using highway straight edges, darbies or bull floats.
    - b. Create control and construction joints true to line and profile. Do not radius the joints. Refer to the Drawings for structural requirements of joints.
    - c. Locate joints as indicated on the Drawings but in no case shall joint spacing exceed 16 feet or 47 times the slab thickness in both directions and maximum area between joints shall not exceed 200 square feet. Locate joints on column centers and at re-entrant corners where possible.
    - d. Sawcut control joints to one-quarter of slab depth, immediately after slab has achieved initial set and not longer than 8 hours. "Soff-Cut" method is preferred.
    - e. Alternate control and construction joint products and procedures will be considered in accordance with substitution provision specified in Section 01 60 00 - Product Requirements.
- F. Notify Architect not less than 24 hours prior to commencement of placement operations.
- G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- H. Ensure reinforcement, inserts, and waterstops will not be disturbed during concrete placement.

- I. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- J. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### **3.05 SLAB JOINTING**

- A. Locate joints as indicated on drawings.
  - 1. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
  - 1. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 92 00 for finish joint sealer requirements.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
  - 1. Install where indicated and required on Structural Drawings, to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
  - 2. Separate slabs on grade from vertical surfaces with joint filler.
  - 3. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, or as indicated.
    - a. Structural slab contact at foundation walls and grade beams shall be doweled as detailed.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

### **3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES**

- A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for compliance with specified tolerances.
- B. Maximum Variation of Surface Flatness:
  - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
  - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
  - 3. Under Carpeting: 1/4 inch in 10 feet.
- C. For the following applications, depressions in slab floors between high spots shall be a maximum 1/8 inch in 10 ft., using a metal straight edge placed at any location on slab, and measured within 72 hours of pour.



1. Slabs receiving thin-set ceramic tile as specified in Section 09 30 00 - Tiling.
  2. Additional floor finishes may require similar tolerances that are not noted here. Refer to individual sections for their requirements.
- D. Curbs:
1. Top of Curb: 1/4 inch in 10 ft, non-cumulative.
  2. Side of Curb: 1/8 inch in 10 ft, non-cumulative, vertical and horizontal.
- E. Correct the slab surface if tolerances are less than specified.
- F. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### **3.07 CONCRETE FINISHING**

- A. Repair surface defects, immediately after removing formwork.
1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting without damaging reinforcement. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
  2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.
- B. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include ceramic tile with full bed setting system.
  2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, and thin set ceramic tile.
  3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

### **3.08 CURING AND PROTECTION**

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
1. Normal concrete: Not less than seven days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
  - a. Spraying: Spray water over floor slab areas and maintain wet.
  - b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
3. Final Curing: Begin after initial curing but before surface is dry.
  - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
  - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

### **3.09 MISCELLANEOUS CONCRETE ITEMS**

- A. Filling In: Fill in holes and openings left in concrete structures for passage of Work specified in other Sections, after such Work is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work. Use non-shrink grout where required or indicated.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. 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 diagrams or templates of manufacturer furnishing machines and equipment.

### **3.10 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- C. Provide free access to concrete operations at project site and cooperate with appointed firm.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- E. Field Certifications: For all concrete, provide signed copy of batch plant's certificate stating quantity of each material, amount of water, admixtures, departure time and date accompanying each load of materials or concrete.
- F. Field Tests of Concrete: Perform tests in accordance with applicable California Building Code requirements, ACI 301 and requirements of authorities having jurisdiction.

- G. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- H. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure four concrete test cylinders. Obtain test samples for every 2,000 sq ft - 50 cu yd or less and structural concrete of each class of concrete placed (CBC requirement).
  - 1. Test one cylinder at 7 days and two at 28 days after placement.
  - 2. Maintain fourth cylinder to be tested at 56 days only if 28-day test fails to meet strength requirement.
  - 3. Take one additional test cylinder during cold weather concreting and cure it at job site under same conditions as concrete it represents. Test cold weather cylinder at 28 days.
- I. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- J. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- K. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

### **3.11 DEFECTIVE CONCRETE**

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
  - 1. Obtain repair details from Architect (Structural Engineer) and approved by AHJ before proceeding.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

### **3.12 PROTECTION**

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.
- B. Protect concrete from marring and damage due to weather and construction activities.
  - 1. Protective measures shall include providing temporary coverings, and be in accordance with Section 01 50 00 - Temporary Facilities and Controls, and shall prohibit all non-essential construction activities, including cleaning and maintenance of construction equipment.
  - 2. In particular, protect concrete floor slabs from oil, paint and other products that might penetrate and degrade concrete surface.

## **END OF SECTION**

## **SECTION 03 35 11 CONCRETE FLOOR FINISHES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface treatments for concrete floors and slabs.
- B. Liquid densifiers and hardeners.
- C. Clear penetrating sealers. CONC-2

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

#### **1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with concrete floor placement and concrete floor curing.
- B. Pre-Concrete Placement Meeting:
  - 1. Prior to the start of concrete placement Contractor shall conduct a meeting to review the required methods and procedures to achieve the required finish. Contractor shall send a meeting agenda to all attendees 20 days prior to the scheduled date of the meeting
  - 2. The Contractor shall require responsible representatives of every party concerned with the concreting work to attend the meeting, including but not limited to the following: Contractor's superintendent, ready-mix company, testing lab, topping and coating applicator, and Owner Representative.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
- D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Specimen Warranty: Manufacturer warranty.
- F. Certification: Submit manufacturer's certificate that all materials supplied conform to applicable Federal regulations and to applicable State and Local air pollution emission ordinances and regulations.

#### **1.05 MOCK-UP**

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.

1. Demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

#### **1.07 FIELD CONDITIONS**

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F minimum.

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on the Date of Final Inspection.
- C. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. All products used shall meet VOC requirements listed in Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Requirements for Physically Disabled: Provide flooring meeting slip-resistant requirements of California Code of Regulations (CCR), Title 24, Part 2, CBC Ch. 11B and 2010 ADA Standards, latest amendment.
  1. Flooring demonstrating a coefficient meeting the intent of slip resistance; CBC Ch. 11B-302 Floor or Ground Surfaces, CBC Ch. 11B-403 Walking Surfaces, and ADA Standards.
    - a. Also acceptable: A dynamic coefficient of friction of at least 0.42 per DCOF AcuTest ANSI A137.1 Section 9.6 or ASTM F609.
  2. Flooring surface shall be stable, firm, and slip resistant. CBC Ch. 11B-302.1 General.
  3. Flooring surface demonstrating a dynamic coefficient of friction of at least 0.42 wet per DCOF AcuTest ANSI A137.1 Section 9.6 and ANSI/NFSI B101.3 (using a BOT-3000 testing unit) will be accepted as meeting the intent of slip resistance; CBC Ch. 11B-302 Floor or Ground Surfaces and ADA Standards.
    - a. Ramp surface: Provide DCOF value of 0.46 wet.

#### **2.02 CONCRETE FLOOR FINISH APPLICATIONS**

- A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.
- B. Liquid Densifier and Hardener:

1. Use at following locations: concrete floors on grade.
- C. Penetrating Clear Sealer:
  1. Use at following locations: Concrete floors with sealer, CONC-2.
- D. Slip Resistant Coating: Finely-ground aggregates added to coatings.
  1. Use at following locations: CONC-2.

### **2.03 SURFACE TREATMENTS**

- A. Troweling Aid, Densifier and Curing Agent: Liquid reactive colloidal silica-based topical treatment, spray-applied to wet concrete and floated or troweled into the surface.
- B. Surface Etching: A water-based liquid or gel compound to remove the concrete surface by chemically etching to produce a certain profile.
  1. VOC Compliance: Less than 40 g/L. Conform to SCAQMD 1113 requirements.
  2. Concrete Surface Profile: CSP-1 Acid Etched.
  3. Products:
    - a. Ameripolish Inc.; EZ Etch-Concrete Surface Etching Agent: [www.ameripolish.com](http://www.ameripolish.com).
    - b. Eco Safety Products; Ecoprocote-EcoEtch Pro Concrete Etcher & Cleaner: [www.ecosafetyproducts.com](http://www.ecosafetyproducts.com).
    - c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### **2.04 DENSIFIERS AND HARDENERS**

- A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
  1. Composition: Lithium silicate.
    - a. Products:
      - 1) Dayton Superior Corporation; Densifier J13: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
      - 2) Euclid Chemical Company; ULTRASIL LI+: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
      - 3) PROSOCO, Inc; ColorHard used with Consolideck LS or LS/CS: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).
      - 4) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
  2. Composition: Sodium silicate.
    - a. Products:
      - 1) Curecrete Distribution, Inc; Ashford Formula: [www.curecrete.com/#sle](http://www.curecrete.com/#sle).
      - 2) Euclid Chemical Company; EUCOSIL: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
      - 3) L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; SEAL HARD: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
      - 4) Nox-Crete Inc; Duro-Nox: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
      - 5) Paul M. Wolff Co.; SHUR-HARD: [www.paulwolffco.com](http://www.paulwolffco.com).
      - 6) SpecChem, LLC; Cure Hard: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
      - 7) W. R. Meadows, Inc; Liqui-Hard: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).

- 8) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
3. Composition: Hybrid silicate.
  - a. Products:
    - 1) Ameripolish, Inc; 3D HS Hybrid Silicate Densifier: [www.ameripolish.com/#sle](http://www.ameripolish.com/#sle).
    - 2) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## 2.05 COATINGS

- A. CONC-1 Penetrating Sealer: Transparent, nonyellowing, water-based coating.
  1. USDA approved for use with Food and Beverage.
  2. Composition: Hybrid.
    - a. Products:
      - 1) Ameripolish, Inc; 3D SP Concrete Sealer: [www.ameripolish.com/#sle](http://www.ameripolish.com/#sle).
      - 2) Aqua-Mix; Sealer's Choice Gold: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
      - 3) Curecrete Distribution, Inc; Ashford Formula: [www.curecrete.com/#sle](http://www.curecrete.com/#sle).
      - 4) Glaze N' Seal; Glaze N' Seal Multi-Purpose Sealer : [www.glaze-n-seal.com](http://www.glaze-n-seal.com).
      - 5) L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; L&M Permaguard SPS: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
      - 6) Paul Wolff Co.; Royal-Sheen: [www.paulwolff.com](http://www.paulwolff.com)
      - 7) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
  3. Composition: Epoxy.
    - a. Products:
      - 1) Arizona Polymer Flooring; Epoxy 100 : [www.apfepoxy.com](http://www.apfepoxy.com).
      - 2) Rustoleum Corporation; Product - Water Based Epoxy 6010 System : [www.rustoleum.com](http://www.rustoleum.com). Also available through Vista Paint, [www.vistapaint.com](http://www.vistapaint.com).
      - 3) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Plastic Aggregate: Finely ground polymer for addition to coatings for slip resistance.
  1. Products:
    - a. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Euclid Chemical Company; EUCO GRIP: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. SpecChem, LLC; Surface Grip: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - d. W. R. Meadows, Inc; Sure-Step: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Concrete Substrate: Structurally sound.

- C. Concrete Age: Minimum 28 days old.
- D. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

### **3.02 PREPARATION**

- A. Blow clean using unoled air or vacuum clean.
- B. Surface profile shall be CSP 2-5 per ICRI 310.2R.

### **3.03 GENERAL**

- A. Apply materials in accordance with manufacturer's instructions.

### **3.04 COATING APPLICATION**

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.
- E. Broadcast system:
  - 1. Apply first layer of coating with non-slip aggregate as recommended by manufacturer.
  - 2. Apply topcoat as recommended by manufacturer.

### **3.05 SURFACE DENSIFIER/SEALER APPLICATION**

- A. New Concrete: Apply cure-seal-hardener to new concrete as soon as the concrete is firm enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.

**END OF SECTION**



## **SECTION 04 20 00 UNIT MASONRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Concrete block. CMU-1 & CMU-2
  - 1. Applications: Trash Enclosure and Site Walls.
- B. Mortar and grout. M-1
- C. Reinforcement and anchorage.
- D. Accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 07 25 00 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
- B. ASTM C91/C91M - Standard Specification for Masonry Cement.
- C. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
- D. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- F. ASTM C150/C150M - Standard Specification for Portland Cement.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- J. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- K. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

- B. Product Data: Provide data for masonry units and masonry accessories.
- C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- F. Installer's Qualification Statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
  - 1. Maintain one copy of each document on project site.
- B. Regulatory Requirements: Except as modified by the requirements specified herein or the details indicated, reinforced concrete unit masonry construction shall conform to the California Building Code (CBC), Title 24, Part 2, Chapter 21A - Masonry.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- E. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

#### **1.07 MOCK-UPS**

- A. Before the installation of masonry work, and if requested by Architect, construct a masonry wall as a mock-up panel sized 4 feet long by 3 feet high; include mortar and accessories and structural backup in mock-up.
- B. Locate where directed.
- C. Obtain the Architect's acceptance of visual qualities of the mock-up before proceeding with masonry work. Mock-up shall be the standard for judging completed masonry work.
- D. Mock-up may remain as part of work.
- E. Do not alter, move or destroy mock-up until work is completed.
- F. Sealer Test Panel: Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer's application instructions. Let test area protective treatment cure before inspection. Keep test panels available for comparison throughout the protective treatment project.

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
  - 1. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

## **PART 2 PRODUCTS**

### **2.01 CONCRETE MASONRY UNITS**

- A. Acceptable Manufacturers:
  - 1. Angeles Block Co., Inc.: [www.angelusblock.com](http://www.angelusblock.com).
  - 2. Orco Block Co.: [www.orco.com](http://www.orco.com).
  - 3. RCP Block and Brick: [www.rcpblock.com](http://www.rcpblock.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches or as indicated and nominal depths as indicated on the Drawings for specific locations.
  - 2. Special Shapes: Provide nonstandard blocks configured for corners.
  - 3. Load-Bearing Units: ASTM C90, medium weight.
    - a. Hollow block, as indicated.
    - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
    - c. Pattern: As indicated on Drawings.
    - d. Unit Compressive Strength: Where indicated, provide units with minimum average net area compressive strength of 2,000 psi (Type M or S) and not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
  - e. Nonloadbearing Units: ASTM C129.
    - 1) Hollow block, as indicated.
    - 2) Medium weight.
  - f. Solid Cap Unit: Nominal unit size, texture and color to match adjacent wall, unless specified otherwise.

### **2.02 MORTAR AND GROUT MATERIALS**

- A. All materials to conform to CBC, Section 2103.2 and 2103.3.
- B. Masonry Cement: ASTM C91/C91M, Type S.
- C. Portland Cement: ASTM C 150, Type II.
  - 1. Not more than 0.60 percent alkali.
- D. Hydrated Lime: ASTM C207, Type S.

- E. Mortar Aggregate: ASTM C 144, except for joints less than 1/4-inch use aggregate graded with 100 percent passing the No. 16 sieve.
- F. Grout Aggregate: ASTM C404.

### **2.03 REINFORCEMENT AND ANCHORAGE**

- A. Reinforcing Steel: Type specified in Section 03 20 00; size as indicated on drawings; uncoated finish.

### **2.04 ACCESSORIES**

- A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.
  - 1. Manufacturers:
    - a. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
    - b. Dur-O-Wal: [www.dur-o-wal.com](http://www.dur-o-wal.com).
    - c. Hohmann & Barnard, Inc: [www.h-b.com](http://www.h-b.com).
    - d. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; 3/8 inch wide by maximum lengths available.
  - 1. Manufacturers:
    - a. Hohmann & Barnard, Inc: [www.h-b.com](http://www.h-b.com).
    - b. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
  - 1. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.
  - 2. Basis of Design Product: Enviro Klean as manufactured by ProSoCo, Inc., [www.prosoco.com](http://www.prosoco.com), or equal.
- D. Proprietary Acidic Cleaners: Standard-strength cleaners designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below.
  - 1. Do not discolor or damage masonry surfaces.
  - 2. Cleaners shall be expressly approved for intended use by manufacturer of masonry units being cleaned.
  - 3. Comply with applicable occupational safety and hazardous and toxic materials regulations in handling and disposing of solutions.
  - 4. General Purpose Cleaner: For removal and control of efflorescence, removal of excess mortar, grout and common construction soiling from new masonry not subject to metallic oxidation stains.
    - a. Basis of Design Product: Sure Klean No. 600 as manufactured by ProSoCo, Inc., [www.prosoco.com](http://www.prosoco.com), or equal.

5. Cleaner for Asphalt and Tar: For removing asphalt, tar, grease, hydraulic oil, motor oil and similar materials from porous masonry.
  - a. Basis of Design Product: Sure Klean Asphalt & Tar Remover as manufactured by ProSoCo, Inc., [www.prosoco.com](http://www.prosoco.com), or equal.
6. Cleaner for Lime Putty Stains: For removing excess mortar, heavy lime deposits and normal construction stains from new masonry surfaces where high-strength lime putty mortar mixes have been used.
  - a. Basis of Design Product: Sure Klean 101 Lime Solvent as manufactured by ProSoCo, Inc., [www.prosoco.com](http://www.prosoco.com), or equal.

## **2.05 MORTAR AND GROUT MIXING**

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  1. Do not use calcium chloride in mortar or grout.
  2. Integral color mortar as selected by Architect from manufacturers standard color selection.
  3. Minimum grout strength  $f'c = 2,000$  psi as indicated on Drawings.
  4. Minimum mortar strength  $f'c = (S) 1,800$  psi, as indicated on Drawings.
- B. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  1. Masonry below grade and in contact with earth: Type S.
  2. Exterior, loadbearing masonry: Type N.
  3. Interior, loadbearing masonry: Type N.
- C. Mixing: Use mechanical batch mixer and comply with referenced standards.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Comply with CBC Section 2104 in addition to referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.
- C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

- D. Cut or trim interior of face shells or cross webs of masonry units, where necessary, to provide a minimum clearance of 1/2 inch or one bar diameter, whichever is greater, to reinforcing bars.
- E. Protection of Unit Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each workday. Cover partially completed unit masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.
- F. Stain Prevention: Prevent grout, mortar, and soil from staining the face of unit masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
- G. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.

### **3.03 COLD AND HOT WEATHER REQUIREMENTS**

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

### **3.04 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.

### **3.05 PLACING AND BONDING**

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
  - 1. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
  - 2. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Lay hollow masonry units with face shell bedding on head and bed joints.
- D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- E. Remove excess mortar and mortar smears as work progresses.
- F. Interlock intersections and external corners, except for units laid in stack bond.

- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools (motor-driven saws) to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Use full-size units without cutting where possible.

### **3.06 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHER MASONRY**

- A. Place continuous joint reinforcement in first and second joint below top of walls.
- B. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- C. Lap joint reinforcement ends as indicated on Drawings, minimum 6 inches.
- D. Reinforce joint corners and intersections with strap anchors 16 inches on center.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches horizontally and 16 inches vertically.

### **3.07 GROUTED COMPONENTS**

- A. Lap splices as indicated on Drawings.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.

### **3.08 CONTROL AND EXPANSION JOINTS**

- A. Control Joints: As indicated on Drawings.
- B. Control Joints: Locate control joints maximum 24 feet on center or as indicated. If not shown, provide submittal to Architect with proposed locations for approval.
- C. Expansion Joints: As indicated on Drawings.
- D. Do not continue horizontal joint reinforcement through control or expansion joints.
- E. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- F. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- G. Comply with Section 07 92 00 for sealant performance.
- H. Form expansion joint as detailed on drawings.

### **3.09 BUILT-IN WORK**

- A. As work progresses, install built-in fabricated metal frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

- D. Do not build into masonry construction organic materials that are subject to deterioration.

### **3.10 TOLERANCES**

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Verify tolerances prior to placing next course. If the unit placed does not meet the tolerances listed below, it shall be removed and reinstalled to meet specified tolerances at no additional cost to Owner.
- C. Maximum Variation from Alignment of Columns: 1/4 inch.
- D. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- E. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- F. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- G. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- H. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- I. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### **3.11 CUTTING AND FITTING**

- A. Cut and fit for chases and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### **3.12 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

### **3.13 REPAIRING AND POINTING**

- A. Repairing: Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

### **3.14 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.



- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.
- E. 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 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
  - 4. Clean concrete unit masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

### **3.15 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

## **SECTION 05 12 00 STRUCTURAL STEEL FRAMING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Structural steel framing members. (Trash Enclosure and Solar Canopies)
- B. Structural steel support members.
- C. Grouting under base plates.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 12 13 - Architecturally-Exposed Structural Steel Framing: Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).
- B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

#### **1.03 REFERENCE STANDARDS**

- A. AISC (MAN) - Steel Construction Manual.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
- C. AISC 341 - Seismic Provisions for Structural Steel Buildings.
- D. AISC 358 - Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.
- E. AISC 360 - Specification for Structural Steel Buildings.
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- H. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- K. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- L. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- M. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
- N. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

- O. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- P. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
- Q. ASTM E23 - Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
- R. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
- S. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
- T. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry.
- U. ASTM E709 - Standard Guide for Magnetic Particle Testing.
- V. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
- W. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
- X. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- Y. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- Z. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- AA. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- BB. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- CC. AWS D1.8/D1.8M - Structural Welding Code - Seismic Supplement.
- DD. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.
- EE. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.
- FF. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- GG. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).
- HH. SSPC-SP 2 - Hand Tool Cleaning.
- II. SSPC-SP 3 - Power Tool Cleaning.
- JJ. SSPC-SP 13 - Surface Preparation of Concrete.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
  - 2. Indicate cambers and loads.

- 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.
- E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.
- F. Materials Test Reports: Submit independent test results or engineered performance analysis of structural thermal-break pad performance in bearing or slip-critical connections where shear and moment loads are applied.
- G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- H. Fabricator's Qualification Statement.
- I. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

### **1.05 QUALITY ASSURANCE**

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 05 12 13.
- C. Maintain one copy of each document on site.
- D. Fabricator: Company specializing in performing the work of this section with minimum five years of documented experience.
- E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- F. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- G. Erector: Company specializing in performing the work of this section with minimum five years of documented experience.
- H. Inspection: The Owner will employ a special inspector during all welding, and high-strength bolt installations and tightening operations, in accordance with California Building Code (CBC) requirements and other requirements of authorities having jurisdiction.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with applicable provisions of the following building codes, including special inspection provisions:
  - 1. California Building Code (CBC), Chapters 17A and 22A.
- B. Comply with applicable provisions of the following specifications and documents as modified by the building codes:
  - 1. AISC 341 and Supplement No. 1.

2. AISC 358.
3. AISC 360 including high-seismic applications.
4. AWS D1.1/D1.1M, "Structural Welding Code-Steel".
5. AWS D1.8/D1.8M, "Structural Welding Code-Seismic Supplement".
6. RCSC (HSBOLT).

## 2.02 MATERIALS

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
  1. Unless indicated as Grade 50 on Drawings.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- E. Steel Bars: ASTM A108.
- F. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
- G. Pipe: ASTM A53/A53M, Grade B, Finish black.
- H. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.
- I. Structural Bolts and Nuts: As indicated on Structural Drawings.
- J. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
- K. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.
- L. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.
- M. Headed Anchor Rods: ASTM F1554 Grade 36, plain.
- N. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.
- O. Welding Materials: AWS D1.1/D1.1M and BHMA A156.31; type required for materials being welded.
  1. Provide E70XX-low hydrogen electrodes for shielded metal arc welding.
  2. Provide E71TXX wire type for flux-cored arc welding.
  3. The filler metal used for the welding of members of the lateral load resisting system, shall have a notch toughness not less than 20 ft.-lbs. at 20F. as measured by a standard Charpy V-notch test, ASTM E23, in accordance with the applicable filler metal specification referenced in [AWS D1.1/D1.1M](#).
- P. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
  1. Provide minimum compressive strength as indicated on Drawings.
  2. Height Change, Plastic State; when tested according to ASTM C827/C827M:
    - a. Maximum: Plus 4 percent.

- b. Minimum: Plus 1 percent.
- Q. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
  - 1. SSPC-Paint 15, standard color.
  - 2. Low-Emitting Materials: Paints and coatings 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."
- R. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### **2.03 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.
- D. Develop required camber for members.

### **2.04 FINISH**

- A. General: Materials and fabrication procedures shall be subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency, as specified in Section 01 40 00 - Quality Requirements and Section 01 45 33 - Code-Required Special Inspections.
  - 1. Such inspections and tests do not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
  - 2. Promptly remove and replace materials or fabricated components that do not comply.
- B. Prepare structural component surfaces in accordance with SSPC-SP 3.
- C. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
- D. Galvanize all exterior structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

### **2.05 SOURCE QUALITY CONTROL**

- A. Provide shop testing and analysis of structural steel.
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 100 percent of bolts at each connection.
- C. Welded Connections: Visually inspect continuously or periodically per the DSA Form 103 all shop-welded connections and test at least 20 percent of welds using one of the following:
  - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
  - 2. Ultrasonic testing performed in accordance with ASTM E164.
  - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
  - 4. Magnetic particle inspection performed in accordance with ASTM E709.

- a. Performed on root pass and on finished weld.
- b. Cracks or zones of incomplete fusion or penetration not acceptable.
- D. See also part 3 article "Field Quality Control".

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

### **3.02 ERECTION**

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

### **3.03 TOLERANCES**

- A. Level and plumb individual members of structure within specified AISC tolerances.
- B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- C. Maximum Offset From True Alignment: 1/4 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts."
- C. Welded Connections: Visually inspect continuously or periodically per the DSA Form 103 all field-welded connections and test at least 80-100 percent of welds using one of the following:
  - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
  - 2. Ultrasonic testing performed in accordance with ASTM E164.
  - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
  - 4. Magnetic particle inspection performed in accordance with ASTM E709.

- D. Report: Welding inspector will submit a signed report to the Architect, Structural Engineer, Project Inspector, and Authority Having Jurisdiction (City Building Department) verifying that welding was performed in compliance with specified and Code-mandated requirements and that adequate methods were used to determine the quality of the welding.
- E. Re-Inspection: After correction of deficiencies in structural steel work which inspections and test reports indicate, additional inspections and tests will be performed to confirm that structural steel complies with specified requirements. Costs of re-inspections shall be paid in accordance with Conditions of the Contract.

### **3.05 CLEANING AND TOUCH-UP**

- A. Cleaning: Perform initial cleaning immediately after completion of installation. Prepare surfaces for finish painting.
- B. Galvanizing Touch-Up: Touch up galvanizing immediately after installation, including field welding.
  - 1. Prepare surface and apply cold galvanizing compound in compliance with ASTM A780/A780M and the manufacturer's instructions and recommendations.
- C. Primer Paint Touch-Up: Touch up shop paint immediately after erection. Use products compliant with Section(s) 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting.
  - 1. Clean exposed areas of rust, field welds, bolted joints, and areas where primer is damaged by SSPC-SP 2 hand tool cleaning or SSPC-SP 3 power-tool cleaning.
  - 2. Paint with applicable SSPC-Paint 15 (interior) or SSPC-Paint 20 (exterior) compliant material used for shop painting, minimum 3 mils dry film thickness.

### **END OF SECTION**



## **SECTION 05 31 00 STEEL DECKING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Roof deck.
- B. Supplementary framing for openings up to and including 18 inches.
- C. Bearing plates and angles.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 04 20 00 - Unit Masonry: Placement of anchors for bearing plates embedded in unit masonry assemblies.
- B. Section 05 12 00 - Structural Steel Framing: Support framing for openings larger than 18 inches.
- C. Section 05 50 00 - Metal Fabrications: Steel angle concrete stops at deck edges.

#### **1.03 REFERENCE STANDARDS**

- A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures.
- B. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- I. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.
- K. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems.
- L. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements.
- M. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.
- N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

P. UL (FRD) - Fire Resistance Directory.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
  - 1. Provide the following data as verified by IAPMO or ICC Evaluation Service Reports:
    - a. Non-composite flexural effective section moduli and moments of inertia.
- C. Structural design of the system using the products shown on the Drawings has already been used as a basis of approval by City Building Department and other agencies.
  - 1. If a substitution is proposed, then the Contractor is responsible for the re-approval of the documents in a timely manner within the original project schedule, along with all professional and agency fees related to this substitution.
  - 2. See Section 01 60 00 - Product Requirements.
- D. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
  - 1. Field Measurements: Before starting shop and erection drawings, verify measurements, lines, grades, elevations, locations and details of field conditions and be responsible for correctness, conformance, accuracy and execution of construction to conform to actual conditions.
  - 2. Detail the construction in conformance with the AISC Detailing for Steel Construction, 2nd Edition, except where otherwise indicated.
  - 3. Field Connections and Placement Diagrams: Show field connection and placement diagrams on the erection drawings with complete details, layouts and dimensions.
  - 4. Changes: Minor, non-structural changes from the design drawings may be shown on the shop and erection drawings provided they are clearly indicated as such. Structural changes must have prior approval from the Architect and City Building Department (AHJ) Structural Safety Section.
- E. Certificates: Certify that products furnished meet or exceed specified requirements.
  - 1. Insurance Certification: Assist the Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.
  - 2. The equivalency of all proposed decking is subject to acceptance by the Architect.
- F. Submit manufacturer's installation instructions.
- G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172, AISC 201, or City of Los Angeles Certified Fabricator.

### **1.05 QUALITY ASSURANCE**

- A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172, AISC 201, or City of Los Angeles Certified Fabricator.
- C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

### **1.06 REGULATORY REQUIREMENTS**

- A. Regulatory Requirements: Furnish and install metal deck in accordance with the manufacturer's current ICC Evaluation Service Report and UL listing requirements to obtain diaphragm values and fire ratings indicated.
- B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire rated construction.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Steel Deck:
  - 1. ASC Steel Deck: [www.ascsteeldeck.com](http://www.ascsteeldeck.com).
    - a. Structural Roof Evaluation Report: IAPMO ER-0161; 06/30/23.
  - 2. Epic Metals Corporation: [www.epicmetals.com](http://www.epicmetals.com).
    - a. Evaluation Report: IAPMO ER-0226; 06/30/23.
  - 3. Nucor-Vulcraft Group: [www.vulcraft.com/#sle](http://www.vulcraft.com/#sle).
    - a. Evaluation Report: IAPMO ER-0423; 03/31/23.
  - 4. Verco Decking, Inc (a Nucor Company): [www.vercodeck.com](http://www.vercodeck.com).
    - a. Evaluation Report: IAPMO ER-2018; 07/31/23.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
    - a. Substitution may or may not be accepted after Architect and Owner review with complete evaluation for content and schedule impact.
    - b. Substitutions shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies. Revisions to shop drawings illustrating changes is not considered adequate for AHJ review and approval.

- c. Substitutions may be acceptable, based on Architect's review and approval, for submittal to AHJ. If substituted manufacturer cannot reproduce AHJ design and approval in a timely manner, then they shall be subject to a time and material back charge for any delays in the project. Architect approval is required prior to AHJ submittal and AHJ approval is required prior to installation.

## **2.02 STEEL DECK**

- A. All Deck Types: As indicated on Drawings.
- B. Roof Deck: As indicated on Drawings.
  - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
    - a. Grade as required to meet performance criteria.
  - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
  - 3. Structural Properties:
    - a. Span Design: Multiple.
  - 4. Minimum Base Metal Thickness: As indicated on Drawings.
  - 5. Nominal Height: 1-1/2 inch.
  - 6. Profile: Fluted; SDI WR.
  - 7. Formed Sheet Width: Per manufacturer's ICC or IAPMO approved product.
  - 8. Side Joints: Lock seam.
  - 9. End Joints: Welded to structure.

## **2.03 ACCESSORY MATERIALS**

- A. Bearing Plates and Angles: As indicated on Drawings.
- B. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.
- C. Welding Materials: AWS D1.1/D1.1M and AWS D1.3/D1.3M.
  - 1. Welding Rod: AWS A5.1-91, E70XX, Low Hydrogen.
- D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.
  - 1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
  - 2. Material: Steel; ASTM A510/A510M.
    - a. Hardness: Rockwell C 54.5, minimum.
    - b. Tensile Strength: 285 kips per square inch, minimum.
    - c. Shear Strength: 175 kips per square inch, minimum.
    - d. Washers:
      - 1) Exposed Roof Deck Applications: 0.591 inch diameter, minimum.
    - e. Corrosion Resistance:

- 1) Exposed Roof Deck Applications: Provide manufacturer's standard stainless steel sealing caps with bonded neoprene washer over each fastener.
- E. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
  2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.
  3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.
  4. Hex head, stainless steel, self-drilling screws, #12 or larger, with molded washer to create water tight and permanent seal.
- F. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
1. Low-Emitting Materials: Paints and coatings 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."
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- I. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.
1. Acoustic Sound Barrier Closures: Manufacturer's standard mineral fiber closures.
- J. Finish Paint: Manufacturer's baked-on, rust-inhibitive prime and finish paint, for application to metal surfaces which have been chemically cleaned and phosphate treated. Finish color as scheduled.
1. Finish field coating system of exposed decking specified in Section 09 91 13 - Exterior Painting.

## **2.04 FABRICATED DECK ACCESSORIES**

- A. Sheet Metal Deck Accessories: Metal closure strips, 20 gage, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

### **3.02 INSTALLATION**

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On steel supports provide minimum 2 inch (50 mm) bearing.

- C. Fasten deck to steel support members as indicated on Drawings, at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
  - 1. Welding: Use fusion welds through weld washers.
    - a. Fasten steel panels to supporting beams by electric arc welding by certified welding operators.
  - 2. Place and secure special deep fluted sections for integral concrete bridging.
- D. Fasten side seams by use of Delta Grip tool (ASC) or Punchlok tool (Verco), welding or button punching as indicated on Drawings. Provide all welding attachments or screw attachments as indicated.
  - 1. Clinch lock seam side laps.
  - 2. At mechanically fastened male/female side laps fasten as indicated on Drawings but not more than 24 inches on center maximum.
  - 3. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
  - 4. At welded male/female side laps weld as indicated on Drawings but not more than 18 inches on center maximum.
- E. Weld deck in accordance with AWS D1.3/D1.3M.
- F. At deck openings from 6 inches to 18 inches in size, provide 2 1/2 x 2 1/2 x 3/16 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
- G. At deck openings greater than 18 inches in size, provide steel angle reinforcement. as specified in Section 05 12 00.
- H. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.
- I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
  - 1. Support at Columns: As indicated on Drawings.
    - a. Where, due to cutting of deck units at columns, bearing support is not provided for the end of a web, such web shall be welded to the column or structural steel material at the column or equivalent support shall be provided.
    - b. The welding or equivalent support shall be sufficient for the support of the deck, the "wet" weight of concrete and other construction loads.
- J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- K. Place metal cant strips in position and fusion weld.
- L. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- M. Touch Up of Welds: Upon cooling, touch-up all welds not to be encased in concrete topping with manufacturer's standard priming paint.

- N. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

### **3.03 AS ERECTED DRAWINGS**

- A. After all steel has been erected, correct or revise the shop drawings erection and placement diagrams to correspond with the changes made in the field. Refer to requirements specified in Section 01 78 00 - Closeout Submittals.

### **3.04 FIELD QUALITY CONTROL**

- A. Field testing and inspection are specified in Section 01 45 33 - Code-Required Special Inspections.

**END OF SECTION**

## **SECTION 05 50 00 METAL FABRICATIONS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Shop fabricated steel items.
- B. Requirements for materials and equipment for post-installed mechanical and adhesive anchors in concrete.
- C. Pipe bollards with sleeve covers.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.
- C. Section 09 91 13 - Exterior Painting: Paint finish.
- D. Section 09 91 23 - Interior Painting: Paint finish.
- E. Divisions 10 - Specialties, 22 - Plumbing, 23 - Heating, Ventilating, and Air-Conditioning (HVAC), 26 - Electrical, 27 - Communications, and 28 - Electronic Safety and Security: Mounting of equipment and components.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ACI 355.4 - Qualification of Post-Installed Adhesive Anchors in Concrete.
- C. ACI 440.2R - Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures.
- D. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures.
- E. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.



- L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- M. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- N. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- O. ASTM F594 - Standard Specification for Stainless Steel Nuts.
- P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- S. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.
- T. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.
- U. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.
- V. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- W. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).
- X. SSPC-SP 3 - Power Tool Cleaning.
- Y. SSPC-SP 5 - White Metal Blast Cleaning.
- Z. SSPC-SP 6 - Commercial Blast Cleaning.
- AA. SSPC-SP 10 - Near-White Metal Wet Abrasive Blast Cleaning.
- BB. SSPC-SP 2 - Hand Tool Cleaning.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. ICC ES Reports: If requested, ICC Evaluation Service report indicating conformance with ICC-ES Acceptance Criteria.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172 or AISC 201.

#### **1.05 QUALITY ASSURANCE**

- A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172, AISC 201, or City of Los Angeles Certified Fabricator.
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 and Section 01 45 33 for testing indicated.
- D. Installer Training: Prior to beginning the work, manufacturer or manufacturer's representative shall provide on-site training for all contractor's personnel who will be installing anchors.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Conform to applicable requirements of California Building Code (CBC), Title 24, Part 2, as amended and adopted by authorities having jurisdiction.
  - 1. Comply with Title 24, Part 9, California Fire Code Chapter 35 "Welding and Other Hot Work."

### **2.02 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M, for channels, angles and plates.
- B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.
- C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- D. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- E. Slotted Channel Fittings: ASTM A1011/A1011M.
- F. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- G. Bolts, Nuts, and Washers: As indicated on Drawings.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
  - 1. Comply with SSPC-PA 1. Coordinate with requirements specified in Section 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting .
    - a. Coordinate primer with finish paint and coating, as applicable, to provide sound foundation for field-applied topcoats despite prolonged exposure during construction.
- J. Galvanize all exterior steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.
- K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### **2.03 FABRICATION**

- A. Ferrous Metal Surfaces, General:
  - 1. For metal fabrications exposed to view upon completion of the Work: Provide ferrous metals materials selected for their surface flatness, smoothness, and freedom from surface blemishes.

2. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Hot-dip galvanize fabricated ferrous items, indicated as remaining unpainted, after fabrication. Field connections shall be bolted or screwed where possible. Avoid field cutting and welding which damage galvanized coating.
- C. Fit and shop assemble items in largest practical sections, for delivery to site.
- D. Fabricate items with joints tightly fitted and secured.
- E. Gas cutting of non-structural steel items may be acceptable where stress is not transmitted through flame-cut surfaces.
  1. Make cuts clean and to contour.
  2. Deduct 1/8 inch from effective width of members cut by torch.
- F. Continuously seal joined members by intermittent welds and plastic filler.
- G. Joints Exposed to Weather or Water: Fabricate to keep water out, or provide adequate drainage of water that penetrates.
- H. Steel Tubing and Piping Fabrication: Unless otherwise indicated, close ends with plate stock so no exposed ends of tubing and piping. Grind all edges.
- I. Connections, General:
  1. Component parts of built-up members shall be well-pinned with closely-fitted contact.
  2. Conceal connections where possible.
  3. Otherwise, make countersinks for concealment after fabrication, except where noted.
- J. Welding: Conform to AWS D1.1/D1.1M recommendations.
  1. Do not field weld galvanized components to remain unfinished.
  2. Provide continuous welds at welded corners and seams.
  3. Grind exposed welds smooth and flush with base material.
  4. Re-weld to fill holes. Putties and fillers are not acceptable.
- K. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- L. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
  1. Bolted and Screwed Connections:
    - a. Provide holes and connections for work specified in other Sections.
    - b. Use bolts for field connections only.
    - c. Provide washers under heads and nuts bearing on wood.
    - d. Draw all nuts tight and nick threads of permanent connections.
    - e. Use beveled washers where bearing is on sloped surfaces.
    - f. Where screws must be used for permanent connections in ferrous metal, use flat head type, countersunk, with screw slots filled and finished smooth and flush.

- M. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

## **2.04 FABRICATED ITEMS**

- A. Rough Hardware
  - 1. Provide bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as indicated on Drawings.
- B. Other Products and Fabrications
  - 1. Other Products and Fabrications: Provide all materials not specifically described but required for a complete and proper installation, as selected by the Contractor, subject to review and acceptance by Owner Representative and Architect.
- C. Bollards: Steel pipe, concrete filled, as detailed; galvanized finish.
  - 1. Bollard Sleeve Covers:
    - a. Manufacturer:
      - 1) Encore Commercial Products, Inc.; Flat Top Bollard Cover: [www.postguard.com](http://www.postguard.com).
      - 2) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
    - b. Performance Requirements
      - 1) Ultraviolet Protection Additive. Six (6) Year UV stabilizer package. Warranty 6 Years.
      - 2) Thickness: 0.125 inch nominal wall thickness.
      - 3) Abrasion Resistant.
      - 4) Environmental Stress Cracks Resistant.
      - 5) Reflective Tape: Each sleeve cover to have 2 strips of Reflective tape recessed on the part 5.875 inches apart.
      - 6) Flexural Modulus: 200,000 psi.
      - 7) Tensile Strength: 4,000 psi.
    - c. Materials:
      - 1) HDPE and LDPE Polyethylene:
        - (a) Size: Determined by pipe size and height as indicated on Drawings.
          - (1) Diameter: 4.5 inches, nominal.
        - (b) Standard colors: As selected by Architect (Yellow, White, Blue, Red, Black, Gray, Green, Orange, Brown, Beige, Royal Blue, Canadian Grey, Warm Grey, Lime Green).
        - (c) Reflective Tape Color: As selected by Architect (Red, White, Yellow, Black, Green and Blue).
- D. Lintels: As detailed; galvanized finish.
- E. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; electro-galvanized per ASTM B633 Type III, SC 1 finish.

F. Enclosure Gates:

1. Fabricated steel shapes as detailed on Drawings, hot-dipped galvanized finish after fabrication, with galvanized perforated steel panel infill.
2. Steel Face Panels for Gates:
  - a. Corrugated Panels: 18 gage galvanized steel box-rib style decking, 1-1/2 inches deep; ASC Steel Deck Division of ASC Profiles, Inc., or equal.
3. All welded construction.
4. Hardware: Welded on heavy duty butt hinges, minimum 4-hinges per leaf, latch device mounted 40 inches above finish surface and including padlock eye, drop rod with steel pipe receivers cast into concrete at both open and closed positions (both leafs).
5. At Pedestrian Gate: Provide 16 gage steel sheet kick plate on push side of gate up to a minimum of 10 inches above finish surface.
  - a. Connect kick plates with a 16 gage closure placed on top of kick plates; from front to back plates and side to side. Overlap to outside on top of kick plates a minimum 1/2 inch. Tack or spot weld as required.
  - b. Kick plate to have drain holes in back face to minimize collection of water in bottom of angle frame.
  - c. See also Section 32 31 13 - Chain Link Fences and Gates or 32 31 19 - Decorative Metal Fences and Gates.

G. Plumbing Security Cage:

1. Basis of Design: Sentry Maximum Security Cage as manufactured by D&M Manufacturing, Inc. ( [www.backflowtheft.com](http://www.backflowtheft.com)); or equal.
2. Placer Waterworks: [placerwaterworks.com](http://placerwaterworks.com)
3. Substitutions: See Section 01 60 00 - Product Requirements.
4. Components:
  - a. 3/16 inch Welded Angle Iron Frame.
  - b. High Security 3/4 inch Steel Pin Hinges.
  - c. 9 Gauge Diamond Mesh.
  - d. Zinc Primed.
  - e. Finish: Powder Coated.
  - f. Security Closure Blocks
  - g. Lock Guard.
  - h. Epoxy ready frame.

## 2.05 POST INSTALLED CONCRETE ANCHORS

A. Manufacturers:

1. Manufacturers: Provide products as indicated on the approved Structural Drawings.
2. Substitutions: Substitutions of products from manufacturer's not listed are not permitted.
  - a. Substitution of structural anchors requires structural calculations and AHJ approval.

B. Materials:

1. Conform to ACI 355.4 and ICC ER Report.
2. Interior Use: For use in conditioned environments free from potential moisture, provide zinc plated carbon steel anchors.
3. Exterior Use:
  - a. In exposed or potentially wet environments, and for attachment of exterior cladding materials, provide stainless steel anchors.
  - b. Stainless steel nuts and washers shall be of matching alloy group of equal or greater strength than the rod.
  - c. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
4. Deformed Reinforcing Bars: Deformed steel rebar conforming to ASTM A615/A615M Grade 60. Permissible sizes as described in each adhesive products ICC report.

C. Mechanical Anchors:

1. Expansion, screw or undercut anchors having current ICC approval for use in cracked and uncracked concrete, with a published ICC Evaluation Service report.
  - a. Type and size as indicated on drawings.
2. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to concrete are as indicated on Drawings:
  - a. Hilti, Inc. Tulsa, OK; Hilti Kwik Bolt TZ2 Carbon and Stainless Steel Anchors in Cracked and Uncracked Concrete (ICC Report ESR-4266); [www.us.hilti.com](http://www.us.hilti.com).

D. Adhesive Anchors:

1. Cartridge Injection Adhesive Anchors: Threaded carbon steel rod, inserts, or reinforcing dowels complete with required nuts, washers, adhesive system and manufacturer's installation instructions.
  - a. Type and size as indicated on drawings.
  - b. Current ICC approval for use in cracked and uncracked concrete with a published ICC Evaluation Service report required.
2. Interior Use: Unless otherwise indicated on the Drawings, provide:
  - a. Carbon steel threaded rods conforming to specification as indicated on structural drawings. Where no specification and grade are indicated, provide: ASTM A193/A193M Type B7 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
3. Exterior Use: As indicated on the Drawings, provide stainless steel anchors.
  - a. Stainless steel anchors shall be AISI Type 304 and Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener.
  - b. All nuts shall conform to ASTM F594, unless otherwise specified.
4. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to concrete are as indicated on Drawings:

- 5. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to grouted masonry are as indicated on Drawings:
- E. Power-Driven/Powder Actuated Fasteners
  - 1. Use only if approved by Architect, generally not permitted where not specifically indicated or in load-bearing installations; as indicated on Drawings.
    - a. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.06 FINISHES - STEEL**

- A. Mechanical Finishes: Complete finishing prior to fabrication wherever possible.
  - 1. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match finish.
  - 2. Protect finish on exposed surfaces by using temporary protective covering.
- B. Prime paint steel items.
  - 1. Exceptions: Galvanize items to be embedded in concrete.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- C. Prepare surfaces to be primed in accordance with SSPC-SP2.
  - 1. Exterior fabrications: Clean in accordance with SSPC-SP 5, SSPC-SP 6, 8, or SSPC-SP 10.
  - 2. Interior fabrications: Clean in accordance with SSPC-SP 2, SSPC-SP 3, SSPC-SP 5, SSPC-SP 6, 8, or SSPC-SP 10.
- D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- E. Prime Painting: One coat.
- F. Galvanizing of Structural Steel Members: Galvanize all exterior steel members after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- G. Galvanizing of Non-structural Items: Galvanize all exterior steel members after fabrication to ASTM A123/A123M requirements.

## **2.07 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.
- F. Punch, drill and reaming in manner to leave clean, true lines and surfaces.
  - 1. Oversize hole 1/16 inch by punching, when material thickness is equal to or less than bolt diameter plus 1/8 inch.
  - 2. Sub-punch 1/16 inch smaller than bolt and drill or ream to oversize by 1/16 inch, when material thickness is thicker than bolt diameter plus 1/8 inch.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Field Inspection of Fabricated Products: Prior to installation, inspect products for damage and verify markings and dimensions against reviewed submittals.
- C. Environmental Conditions: Do not install products intended for interior locations when spaces are uncovered and unprotected from inclement weather.
- D. Coordination: Coordinate metal fabrications Work with Work specified in other Sections so that related Work shall be accurately and properly joined.
- E. Post Installed Anchors
  - 1. Verification of Conditions
    - a. Base Material Strength: Unless otherwise specified, do not drill holes in concrete until concrete has achieved full design strength.
    - b. Temperature of concrete surface and ambient air temperature must meet manufacturer's requirements prior to use of adhesive anchor products.
    - c. Embedded Items:
      - 1) Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors.
      - 2) Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items.
      - 3) Take precautions as necessary to avoid damaging anything embedded in the concrete including electrical/telecommunications conduit, gas pipes, and plumbing pipes.
      - 4) Notify the Architect if reinforcing steel or other embedded items are encountered during drilling.
    - d. Beginning of installation indicates acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete.
- C. Make provision for erection loads with temporary bracing. Keep work in alignment.
- D. Obtain Architect's review prior to site cutting or making adjustments not indicated on Drawings and reviewed shop drawings.

### **3.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.



- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.
  - 1. Touch up galvanized steel with cold galvanizing compound.

### **3.04 INSTALLATION OF POST-INSTALLED ANCHORS**

- A. Installation shall comply with all manufacturer's instructions and current ICC ESR report.
- B. Post-Installed Anchors in Hardened Concrete.
  - 1. Drilled-in anchors and/or powder driven pins in existing non-prestressed reinforced concrete: use care and caution to avoid cutting or damaging the existing reinforcing bars.
  - 2. Maintain a minimum clearance of one inch between the reinforcement and the drilled-in anchor and/or pin.
- C. Manufacturer shall provide on-site training for all personnel who will be installing post-installed adhesive anchors at the beginning of the work. Installation of anchors must be performed by a certified installer.
- D. Where manufacturer recommends use of special tools for installation of anchors, such tools shall be used, unless otherwise permitted specifically by the Engineer.
- E. Drill holes with rotary impact hammer drills using carbide-tipped bits. Bits must be of type required and permitted by ICC ESR report.
  - 1. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits.
  - 2. Drill bits shall be of diameters as specified by the anchor manufacturer.
  - 3. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
  - 4. Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer.
  - 5. Cored holes may only be used if acceptable to the Engineer and in compliance with ICC ESR report.
- F. Holes shall be cleared of debris after holes are drilled per manufacturer's instructions.
  - 1. For adhesive installations, at a minimum, holes shall be blown out with oil-free compressed air and shall be brushed with a wire or nylon brush.
  - 2. Holes shall than be blown out one additional time with oil-free compressed air.
  - 3. Additional hole cleaning requirements may be required by manufacturer and ICC ESR Report.
- G. During adhesive curing time period, the temperature of the substrate shall be kept above the minimum substrate temperature as defined by the manufacturer. Contractor shall determine the appropriate means and methods to ensure that the temperature is kept above the required minimum temperature required before adhesive installation is begun.

### **3.05 TOLERANCES**

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

### **3.06 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 45 33 - Code-Required Special Inspections.
- B. Inspection: Special inspection of post-installed anchors shall be provided as required by the ICC-ES report for that anchor and not less than the requirements of the Structural Drawings and the following (whichever is the most restrictive):
  - 1. Continuously observe the installation of all anchors, or as specified in the ICC report.
    - a. Minimum anchor embedments, proof loads and torques shall be as shown on the Drawings.
    - b. Load Testing: Per Structural General Notes on Drawings.
    - c. Verify anchor type, anchor dimensions, hole dimensions, anchor spacing, edge distances, anchor embedment and adherence to the manufacturer's published installation instructions.
    - d. For adhesive anchors also verify hole cleaning technique, adhesive expiration date and proper mixing and dispensing.
  - 2. Subsequent inspection of installation will be required when there is a change of personnel doing the installation. Change is defined as any one or more persons drilling or preparing holes, or installing anchors.
  - 3. Visually inspect 100% of all installed anchors.
- C. Reporting:
  - 1. Daily reports shall reference the applicable ICC-ES report number, indicate that all specified criteria were complied with and provide itemized verification of all inspected items.
  - 2. Special Inspector shall immediately report any deviations from the requirements to the Architect.
- D. Defective Work:
  - 1. Installations that are not accepted by the Special Inspector shall be considered defective.
  - 2. Provide additional testing and inspection to determine acceptability of defective work, as directed by the Architect at Contractor's expense.

### **3.07 REPAIR OF DEFECTIVE WORK**

- A. Remove and replace misplaced, defective or malfunctioning anchors at Contractor's expense. Replacement of anchors requires signed structural detail, unless otherwise noted.

- B. Fill empty anchor holes and patch failed anchor locations with high-strength, non-shrink non-metallic grout.

**END OF SECTION**

## **SECTION 06 10 00 ROUGH CARPENTRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Structural dimension lumber framing.
- B. Nonstructural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Subflooring.
- F. Roof-mounted curbs.
- G. Roofing nailers.
- H. Roofing cant strips.
- I. Preservative treated wood materials.
- J. Miscellaneous framing and sheathing.
- K. Communications and electrical room mounting boards.
- L. Concealed wood blocking, nailers, and supports.
- M. Miscellaneous wood nailers, furring, and grounds.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 30 00 - Cast-in-Place Concrete: Setting anchors in concrete.
- C. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 27 00 - Air Barriers: Air barrier over sheathing.
- F. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

#### **1.03 REFERENCE STANDARDS**

- A. AFPA (NDS) - National Design Specification for Wood Construction.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
- E. ASTM F2130 - Standard Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials.

- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- H. AWWA U1 - Use Category System: User Specification for Treated Wood.
- I. CBC - California Building Code.
- J. ICC-ES AC308 - Acceptance Criteria for Termite Physical Barrier Systems.
- K. PS 1 - Structural Plywood.
- L. PS 2 - Performance Standard for Wood Structural Panels.
- M. PS 20 - American Softwood Lumber Standard.
- N. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Evaluation Service Reports: Show compliance with specified requirements.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

#### **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
  - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
  - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at [www.alsc.org](http://www.alsc.org), and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
  - 4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

## **2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19; Maximum 19%.
- D. Stud Framing (2 by 2 through 2 by 6 ):
  - 1. Species: Douglas Fir-Larch.
  - 2. Grade: No. 1 & Better.
- E. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 ):
  - 1. Species: Douglas Fir-Larch.
  - 2. Grade: No. 1 and Better.
    - a. No. 1 & Better for joists and rafters;
    - b. No. 1 for beams and stringers.
- F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 1 or Construction Grade.
  - 2. Boards: No. 2 or Standard Grade.

## **2.03 CONSTRUCTION PANELS**

- A. Subfloor/Underlayment Combination: PS 1 or PS 2 type, rated Single Floor.
  - 1. Panel Type: Plywood.
  - 2. Bond Classification: Exposure 1.
  - 3. Span Rating: 48.
  - 4. Performance Category: 3/4 PERF CAT.
  - 5. Edges: Tongue and groove.
  - 6. Products:
    - a. Roseburg Forest Products; Softwood Plywood: [www.roseburg.com/#sle](http://www.roseburg.com/#sle).
    - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Roof Sheathing: PS 1 type, rated Structural I Plywood Sheathing.
  - 1. Bond Classification: Exterior.
  - 2. Span Rating: 32/16.
  - 3. Performance Category: 15/32 PERF CAT.
  - 4. Edge: Square edge.
- C. Wall Sheathing: PS 2 type plywood.
  - 1. Bond Classification: Exterior.
  - 2. Grade: Structural I Sheathing.
  - 3. Span Rating: 32/16.
  - 4. Performance Category: 15/32 PERF CAT.
  - 5. Edge Profile: Square edge.

- D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- E. Other Applications:
  - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
  - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
  - 3. Other Locations: PS 1, C-D Plugged or better.

## **2.04 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere. Comply with CBC 2304.10.2.1.
    - a. Exterior Wall Coverings: Provide hot dipped or mechanically deposited zinc-coated steel, stainless steel, silicon bronze or copper.
      - 1) Provide coating weights for mechanically deposited zinc coating fasteners complying with ASTM B695, minimum Class 55.
  - 2. Anchors: As indicated on Drawings.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
  - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
  - 2. Basis of Design Product: Connectors as manufactured by Simpson Strong-Tie, or approved equal.
- C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
  - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
  - 2. Basis of Design Product: Connectors as manufactured by Simpson Strong-Tie, or approved equal.
- D. Termite Resistant Base Condition:
  - 1. Termite-Resistant Sill Plate Barrier: Self-adhesive, 4 mil film-backed 64 mil barrier with release sheet; adheres to concrete substrates and blocks termite access.
    - a. Thickness: 68 mil, 0.068 inch.
    - b. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
    - c. Water Vapor Permeance: 0.035 perm, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Products:
      - 1) Basis of Design: Polyguard Products Inc.; TERM® Sill Barrier | Termite Barrier : [www.polyguardproducts.com](http://www.polyguardproducts.com), or approved equal.
      - 2) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

2. Termite-Resistant Sill Flashing: Self-adhesive membrane; 4 mil polyethylene film bonded to 36 mil sealant.
  - a. Thickness: 40 mil, 0.040 inch.
  - b. Width: 12 inches, minimum.
  - c. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC308.
    - 1) ICC ESR 3632.
  - d. Water Vapor Permeance: 0.035 perm, maximum, when tested in accordance with ASTM E96/E96M.
  - e. Pesticide repellency; chlorodane, fipronil, and permethrin: 0 percent penetration, tested to ASTM F2130.
  - f. Products:
    - 1) Basis of Design: Polyguard Products Inc.; TERM® Flashing Barrier | Termite Barrier : [www.polyguardproducts.com](http://www.polyguardproducts.com), or approved equal.
    - 2) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
3. Accessory Sealants: indicated on details to maintain warranty.
  - a. Sill Barrier Sealant: Polygard Detail Sealant PW (California VOC Compliant), or approved equal.
  - b. Sill Flashing Sealant : Polyguard California Sealant, or approved equal.
- E. Sill Flashing: See Section 07 62 00.
- F. Water-Resistive Barrier: See Section 07 25 00.
- G. Air Barrier: See Section 07 27 00.

## **2.05 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.
- B. Preservative Treatment:
  1. Products:
    - a. Lonza Group: [www.wolmanizedwood.com/#sle](http://www.wolmanizedwood.com/#sle).
    - b. Koppers Performance Chemicals, Inc: [www.koppersperformancechemicals.com/#sle](http://www.koppersperformancechemicals.com/#sle).
    - c. Viance, LLC; Preserve ACQ: [www.treatedwood.com/#sle](http://www.treatedwood.com/#sle).
    - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
  2. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    - b. Treat lumber exposed to weather.



- c. Treat lumber in contact with roofing, flashing, or waterproofing.
  - d. Treat lumber in contact with masonry or concrete.
  - e. Treat lumber less than 18 inches above grade.
  - f. Treat lumber in other locations as indicated.
3. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
- a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
  - b. Treat plywood in contact with roofing, flashing, or waterproofing.
  - c. Treat plywood in contact with masonry or concrete.
  - d. Treat plywood less than 18 inches above grade.
  - e. Treat plywood in other locations as indicated.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- B. Coordinate installation of rough carpentry members specified in other sections.

### **3.02 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### **3.03 FRAMING INSTALLATION**

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA (NDS).
- E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.
- F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- G. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

- H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

### **3.04 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
  - 1. Comply with CBC Section 718.2 Fireblocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
  - 1. Cabinets and shelf supports.
  - 2. Wall brackets.
  - 3. Handrails.
  - 4. Grab bars.
  - 5. Towel and bath accessories.
  - 6. Wall-mounted door stops.
  - 7. Chalkboards and marker boards.
  - 8. Wall paneling and trim.
  - 9. Joints of rigid wall coverings that occur between studs.
  - 10. Equipment.

### **3.05 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at each roof opening except where specifically indicated otherwise; form corners by alternating lapping side members.

### **3.06 INSTALLATION OF CONSTRUCTION PANELS**

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
  - 1. At long edges provide solid edge blocking where joints occur between roof framing members.
  - 2. Nail panels to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension parallel or perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.

1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches, measured horizontally.
  2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
- C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  3. Install adjacent boards without gaps.
  4. Size and Location: As indicated on drawings.

### **3.07 SITE APPLIED WOOD TREATMENT**

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

### **3.08 TOLERANCES**

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

### **3.09 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

### **3.10 CLEANING**

- A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
  1. Comply with applicable regulations.
  2. Do not burn scrap on project site.
  3. Do not burn scraps that have been pressure treated.
  4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

## **END OF SECTION**

## **SECTION 06 20 00 FINISH CARPENTRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Finish carpentry items.
- B. Hardware and attachment accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- D. Section 06 41 00 - Architectural Wood Casework: Cabinet hardware.
- E. Section 09 91 23 - Interior Painting: Painting of finish carpentry items.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A135.4 - Basic Hardboard.
- B. ANSI A208.1 - American National Standard for Particleboard.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood.
- F. BHMA A156.9 - Cabinet Hardware.
- G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
- H. NEMA LD 3 - High-Pressure Decorative Laminates.
- I. PS 1 - Structural Plywood.
- J. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork.
- K. WI (MCP) - Monitored Compliance Program (MCP).

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:

1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
2. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
  2. Provide the information required by AWMAC/WI (NAAWS).
  3. Include certification program label.
- D. Samples: Submit two samples of finish plywood, 6 by 8 inch in size illustrating wood grain and specified finish.
- E. Samples: Submit two samples of wood trim 6 inch long.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

#### **1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
  1. Comply with WI (MCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section [www.woodworkinstitute.com/#sle](http://www.woodworkinstitute.com/#sle).
  2. Provide labels or certificates indicating that the work complies with AWMAC/WI (NAAWS) requirements for grade or grades specified.
  3. Provide designated labels on shop drawings as required by certification program.
  4. Provide designated labels on installed products as required by certification program.
  5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.

### **PART 2 PRODUCTS**

#### **2.01 FINISH CARPENTRY ITEMS**

- A. Quality Standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.

- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
  - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Any closed-grain hardwood; prepare for paint finish.

## **2.02 LUMBER MATERIALS**

- A. Softwood Lumber: Douglas Fir species, S4S sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
- B. Hardwood Lumber: Drawing indicated species, S4S sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

## **2.03 SHEET MATERIALS**

- A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.
- D. Particleboard: ANSI A208.1 Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
- E. Hardboard: ANSI A135.4 Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

## **2.04 PLASTIC LAMINATE MATERIALS**

- A. Plastic Laminate: NEMA LD 3, HGS; color as selected by Architect; textured, low gloss finish.
- B. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.
- C. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

## **2.05 FASTENINGS**

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; blind finish in concealed locations and Architect selected finish in exposed locations.
- C. Concealed Joint Fasteners: Threaded steel.

## **2.06 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking: Softwood lumber of indicated species.
- C. Plastic Edge Trim: Extruded convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness; color as selected.

- D. Aluminum Edge Trim: Extruded convex shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; bronze anodized finish.
- E. Primer: Alkyd primer sealer.
- F. Wood Filler: Oil base, tinted to match surface finish color.

## **2.07 HARDWARE**

- A. Hardware: Comply with BHMA A156.9.

## **2.08 WOOD TREATMENT**

- A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.
- C. Water Repellent Preservative Treatment by Dipping Method: WDMA I.S. 4, with 0.25 percent retainage.
- D. Wood Preservative (Surface Application): Clear, Woodlife Classic type, Tris-2,4,6-(Dimethylaminomethyl) Phenol manufactured by Rust-Oleum Corporation.
- E. Shop pressure treat wood materials requiring preservatives to concealed wood blocking.
- F. Provide identification on fire retardant treated material.
- G. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
- H. Redry wood after pressure treatment to maximum 19 percent moisture content.

## **2.09 FABRICATION**

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- C. Cap exposed plastic laminate finish edges with aluminum trim.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- E. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- F. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

## **2.10 SHOP FINISHING**

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish work in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:
    - a. System - 12, Polyurethane, Water-based.
    - b. Stain: As selected by Architect.
    - c. Sheen: Satin.
  2. Opaque:
    - a. System - 4, Latex Acrylic, Water-based.
    - b. Color: As selected by Architect.
    - c. Sheen: Satin.
- E. Back prime woodwork items to be field finished, prior to installation.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

#### **3.02 INSTALLATION**

- A. Install work in accordance with AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.
- C. Set and secure materials and components in place, plumb and level.
- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- E. Install components with nails at 12 inch on center.
- F. Install prefinished paneling with full bed contact adhesive applied to substrate.
- G. Install hardware in accordance with manufacturer's written instructions.

#### **3.03 SITE APPLIED WOOD TREATMENT**

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

#### **3.04 PREPARATION FOR SITE FINISHING**

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 91 23.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.



### **3.05 TOLERANCES**

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

**END OF SECTION**

**SECTION 06 41 00**  
**ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.
- C. Factory finishing. PL-1 & PL-2
- D. Preparation for installing utilities.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 20 00 - Finish Carpentry: Wood trim unrelated to casework.
- C. Section 09 21 16 - Gypsum Board Assemblies: Support framing, grounds, and concealed blocking.
- D. Section 12 36 00 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
- E. BHMA A156.9 - Cabinet Hardware.
- F. CBC - California Building Code.
- G. NEMA LD 3 - High-Pressure Decorative Laminates.
- H. WI (CCP) - Certified Compliance Program (CCP).
- I. WI (MCP) - Monitored Compliance Program (MCP).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
  - 2. Provide the information required by AWMAC/WI (NAAWS).

3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Spare Parts: One of each kind of lock.
  3. Extra Stock Materials: six keys of each kind of lock.

#### **1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
  2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
    - a. A Licensee of the Woodwork Institute's Certified Compliance Program.
  3. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:
  1. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section:  
<https://woodworkinstitute.com/#sle>.
  2. Provide labels or certificates indicating that the installed work complies with AWMAC/WI (NAAWS) requirements for grade or grades specified.
  3. Provide designated labels on shop drawings as required by certification program.
  4. Provide designated labels on installed products as required by certification program.
    - a. 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.
    - b. Each elevation of casework, each laminated plastic top, and each solid surface top shall bear a Woodwork Institute Certified Compliance Label.
  5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

- a. 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.
- 6. 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 the bid.
- 7. Replace, repair, or rework all work for which certification is refused.

#### **1.07 MOCK-UPS**

- A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.
- B. See Section 01 40 00 - Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

#### **1.09 FIELD CONDITIONSCBC CHAPTER 11B**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Requirements for Persons with Disabilities: Provide products meeting requirements of California Code of Regulations (CCR), Title 24, Part 2, CBC, CBC Chapter 11B, and ADA Standards, latest amendment.
  - 1. Operable parts for all accessible casework shall comply with CBC Chapter 11B-309 Operable Parts.
  - 2. Pull hardware shall be U-shaped wire pulls or equally accessible at all accessible casework; CBC Chapter 11B-811.4 Operable Parts.

#### **2.02 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
  - 3. Finish - Semi-Exposed Surfaces: Cabinet Liner.

- a. Cabinet interiors (other than exposed interior surfaces of open or glass front cabinets) including faces of shelving therein, and interior door faces.
- 4. Finish - Concealed Surfaces: Manufacturer's option.
- 5. Door and Drawer Front Edge Profiles: Square edge with thick applied band.
  - a. Provide with subfronts and applied finish fronts securely fastened, with square corners, edges finished with 3 mm purified PVC.
  - b. Doors, Drawer Fronts, and False Fronts: 3 mm purified PVC edge band, color and pattern to match exposed laminate, hot-melt applied.
  - c. All other exposed and semi exposed edges: 1 mm PVC edge band, color and pattern to match exposed laminate.
- 6. Door and Drawer Front Retention Profiles: Fixed panel.
- 7. Casework Construction Type: Type A - Frameless.
- 8. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
  - a. Hinged to swing flat against the face of adjoining cabinet or the side of cabinet
  - b. Do not notch door or cabinet ends, or divisions to receive hinge.
- 9. Patterned Face Layout for Cabinet and Door Fronts: Flush panel.
  - a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
- 10. Cabinet Design Series: As indicated on drawings.
  - a. 100 Series - Base Cabinets without drawers.
  - b. 200 Series - Base Cabinets with drawers.
  - c. 300 Series - Wall hung Cabinets.
  - d. 400 Series - Tall Storage Cabinets.
  - e. 500 Series - Wardrobe Cabinets.
- 11. Adjustable Shelf Loading: 40 psf.
  - a. Deflection: L/144.
  - b. Shelves: 1-M-2 particle board, 1 inch thick, MOE of 950.
  - c. Edge Bands: 1 mm PVC in color to match shelf. All 4 edges of adjustable shelves to receive banding.
- 12. Cabinet Style: Flush overlay.
- 13. Cabinet Doors and Drawer Fronts: Flush style.
- 14. Drawer Side Construction: Manufacturer's option.
- 15. Drawer Construction Technique: As recommended by fabricator.

### **2.03 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.
- B. Lumber shall be sound, kiln dried softwood and/or hardwood meeting the requirements of the NAAWS Grade specified for its intended purpose.

- C. Panels shall contain no added urea-formaldehyde resins and shall be in accordance with the NAAWS requirements for the grade specified.
  - 1. Core: Comply with NAAWS, ANSI A208.2, Grade 150 where required by CSIP.

## **2.04 LAMINATE MATERIALS**

- A. Manufacturers:
  - 1. Arborite: [www.arborite.com/#sle](http://www.arborite.com/#sle).
  - 2. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 3. Lamin-Art: [www.laminart.com](http://www.laminart.com).
  - 4. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  - 5. Wilsonart LLC: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  - 6. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Flame Spread Rating ASTM E84: Provide units bearing the label of Underwriters' Laboratories, or other testing agency acceptable to the State Fire Marshal, indicating that the units provide the specified flame spread rating. CBC Table 803.13.
  - 1. Class C Flame spread rating 26-200, smoke developed 0-450 per ASTM E84.
- D. Provide specific types as indicated.
  - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, color as selected, textured low gloss finish.
  - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, color as selected, textured low gloss finish.
  - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, color as selected, finish as selected.
  - 4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, color as selected, finish as selected.
  - 5. Cabinet Liner: CLS, 0.020 inch nominal thickness, color as selected, finish as indicated.
  - 6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

## **2.05 COUNTERTOPS**

- A. Countertops: See Section 12 36 00.

## **2.06 ACCESSORIES**

- A. Adhesive: Type recommended by NAAWS to suit application.
  - 1. Type I.
  - 2. Urea Formaldehyde adhesives shall not be used.
  - 3. Contact Cement: VOC content of less than 80 g/l.
  - 4. Construction adhesive shall have a VOC content compliant with Section 01 61 16.

5. Manufacturers:
  - a. Franklin International, Inc; Titebond Original Wood Glue: [www.titebond.com/#sle](http://www.titebond.com/#sle).
  - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Aluminum Reveal: Extruded shape; smooth surface finish; of width to match component thickness; clear anodized finish.
  1. Basis of Design Product: indicated on Drawings as manufactured by Fry Reglet, or approved equal.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.

## 2.07 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
  1. Locking 3/4-inch plastic shelf supports for 5 mm hole diameter.: Knap & Vogt Manufacturing Company; Product No. 339: [www.knapandvogt.com](http://www.knapandvogt.com).
  2. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- C. Countertop Brackets: Fixed, concealed vertical leg, side-of-stud mounting.
  1. Materials: Steel L- and T-shapes.
    - a. Finish: Manufacturer's standard, factory-applied, powder coat.
    - b. Color: Black.
    - c. Support Member Depth: 1 inch.
    - d. Support Member Width: 1 inch
    - e. Support Member Length: 18 inches, or as required by counter depth.
  2. Products:
    - a. A&M Hardware, Inc; Concealed Brackets: [www.aandmhardware.com/#sle](http://www.aandmhardware.com/#sle).
    - b. Centerline Brackets; Floating Wall Mount: [www.countertopbracket.com/#sle](http://www.countertopbracket.com/#sle).
    - c. Rakks/Rangine Corporation; Inside Wall Flush Mount Brackets: [www.rakks.com/#sle](http://www.rakks.com/#sle).
    - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- D. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
  1. Comply with CBC 11B-811.4.
  2. Amerock: BP76312-G10, 4 inch Pull, Allison Value Hardware
  3. Rockler: Satin Nickel 4 inch Wire Pull.
  4. Top Knob: M338 - Wire Pull 4 inch - Brushed Satin Nickel - Somerset Collection

5. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- E. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
  1. Basis of Design: 5-pin tumbler, complying with ANSI/BHMA A156.11, Grade 1 manufactured by Olympus Lock.
    - a. Finish: 26D Satin Chrome.
    - b. Drawer Locks: 200W.
    - c. Door Locks: 100DR.
    - d. Sliding Glass Door Lock: 329R (Ratchet Lock).
    - e. Not acceptable: Cam type locks.
  2. Provide locks on approximately 50 percent of all cabinet doors and drawers in classrooms, except accessible sink bases, and as follows:
    - a. A.V. Cabinets.
    - b. Tall Storage Cabinets.
    - c. Display Cabinets.
    - d. Wardrobe.
    - e. Work Area.
    - f. "Personal" Drawers.
    - g. Filing Cabinets.
    - h. Workrooms to have locks on all doors and drawers.
  3. Key locks alike for doors and drawers for each room and master keyed.
  4. Master key project in accordance with Owner's keying requirements.
    - a. Coordinate with Owner's keying at a keying meeting held with the Owner Representative.
    - b. Provide for the Owner's review a keying schedule as part of the final shop drawings.
  5. Metal Strike Plates: Provide cabinet door and drawer locks with metal strike plates to protect against particle board rip out.
  6. Door and drawer locks shall be of pin tumbler design and include working cylinder slides and forwardly removable cylinder to re-key without totally disassembling lock body and passed by ANSI Grade 1 testing.
  7. Locks shall be easily rekeyable pin tumbler with working top slide and retainer staple.
  8. Cabinet Locks:
    - a. Olympus Lock; Product 500DR: [www.olympus-lock.com](http://www.olympus-lock.com).
    - b. Corbin Cabinet Lock; Product 0737 Drawer Lock: [www.cclsecurity.com](http://www.cclsecurity.com).
    - c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
  9. Drawer Locks:
    - a. Olympus Lock; Product 600DW: [www.olympus-lock.com](http://www.olympus-lock.com).
    - b. Corbin Cabinet Lock; Product 0738 Drawer Lock: [www.cclsecurity.com](http://www.cclsecurity.com).



- c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- F. Cabinet Catches and Latches:
  - 1. Catches for Doors Without Locks: Magnetic with aluminum case.
    - a. Amerock; Product No. 145: [www.amerock.com](http://www.amerock.com).
    - b. The Engineered Products Co.; Product EP591: [www.epcohardwaresecurity.com](http://www.epcohardwaresecurity.com).
    - c. Knappe & Vogt Manufacturing Company: [www.knappeandvogt.com/#sle](http://www.knappeandvogt.com/#sle).
    - d. Rockler Companies, Inc: [www.rockler.com/#sle](http://www.rockler.com/#sle).
    - e. Stanley Architectural Hardware; Product CD46.
    - f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Catches for Inactive Leaf of Pairs of Doors With Locks: Elbow catch.
    - a. Amerock; Product E.Z. Flex No. 3675-2G: [www.amerock.com](http://www.amerock.com).
    - b. The Engineered Products Co.; Product No. 1016: [www.epcohardwaresecurity.com](http://www.epcohardwaresecurity.com).
    - c. Ives; Product 2-A92: [www.iveshinges.com](http://www.iveshinges.com).
    - d. Knappe & Vogt Manufacturing Company: [www.knappeandvogt.com/#sle](http://www.knappeandvogt.com/#sle).
    - e. Rockler Companies, Inc: [www.rockler.com/#sle](http://www.rockler.com/#sle).
    - f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- G. Drawer Slides:
  - 1. Type: Full extension, no deflection.
  - 2. Static Load Capacity: As required by drawer size.
    - a. For drawers up to 18 inches wide and less than 4 inches in depth, provide slides with 100 pound capacity.
    - b. For drawers over 18 inches in width and over 4 inches in depth, provide slides with 150 pound capacity.
    - c. Drawer slide capacity with paper storage: 200 pounds.
  - 3. Mounting: Side mounted.
  - 4. Stops: Positive type.
  - 5. Features: Provide self closing/stay closed type.
    - a. With rolling balls, steel rollers and self-lubricating bearings.
  - 6. Manufacturers:
    - a. Accuride International, Inc; Light-Duty Drawer Slides: [www accuride.com/#sle](http://www accuride.com/#sle).
    - b. Accuride International, Inc; Heavy-Duty Drawer Slides: [www accuride.com/#sle](http://www accuride.com/#sle).
    - c. Blum, Inc; MOVENTO: [www.blum.com/#sle](http://www.blum.com/#sle).
    - d. Grant Hardware Company, Division of Hettich International: [www.hettichamerica.com](http://www.hettichamerica.com).
    - e. Hettich America, LP: [www.hettich.com/#sle](http://www.hettich.com/#sle).
    - f. Hafele America Co.

- g. Knappe & Vogt Manufacturing Company; Light-Duty Drawer Slides:  
www.knappeandvogt.com/#sle.
  - h. Knappe & Vogt Manufacturing Company; Medium-Duty Drawer Slides:  
www.knappeandvogt.com/#sle.
  - i. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides:  
www.knappeandvogt.com/#sle.
  - j. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- H. Hinges: Butt self-closing type, BHMA No. A156.9 level, Grade 1, steel with polished finish.
- 1. Manufacturers:
    - a. Blum, Inc; COMPACT BLUMOTION: www.blum.com/#sle.
    - b. Grass America Inc: www.grassusa.com/#sle.
    - c. Hafele America Co.; : www.hafele.com.
    - d. Hardware Resources: www.hardwareresources.com/#sle.
    - e. Hettich America, LP: www.hettich.com/#sle.
    - f. Stanley Hardware Div.: www.stanleycommercialhardware.com.
    - g. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## **2.08 SITE FINISHING MATERIALS**

- A. Stain, Varnish, and Finishing Materials: In compliance with AWMAC/WI (NAAWS), unless noted otherwise.

## **2.09 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
  - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
  - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

## **2.10 SHOP FINISHING**

- A. Finish work in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:

- a. System - 12, Polyurethane, Water-based.
  - b. Stain: As selected by Architect.
  - c. Sheen: Flat.
- 2. Opaque:
  - a. System - 4, Latex Acrylic, Water-based.
  - b. Color: As selected by Architect.
  - c. Sheen: Flat.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install work in accordance with AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
  - 1. Install plumb, level, true and straight with no distortions. Shim as required using concealed shims. Scribe and cut for accurate fit.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
  - 1. Install without distortion so that doors and drawers fit openings and are accurately aligned.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- H. Install finish hardware after all finish work has been completed. Inspect drilling operations for surface splinters or delaminations. Pieces bearing such imperfections will be rejected.

### **3.03 ADJUSTING**

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

### **3.04 CLEANING**

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

## **END OF SECTION**

**SECTION 06 83 16**  
**FIBERGLASS REINFORCED PANELING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glass fiber reinforced plastic panels, FRP-1.
- B. Trim.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

**1.03 REFERENCE STANDARDS**

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. FDA Food Code - Chapter 6 - Physical Facilities.
- G. ISO 846 - Plastics - Evaluation of the Action of Microorganisms.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Crane Composites, Inc: [www.cranecomposites.com](http://www.cranecomposites.com).

2. Marlite: Standard FRP: [www.marlite.com](http://www.marlite.com).
3. Nudo: [www.nudo.com](http://www.nudo.com).
4. Panolam Industries International, Inc; Panolam FRP: [www.panolam.com/#sle](http://www.panolam.com/#sle).
5. Parkland Performance; Plas-Tex PolyWall; [www.parklandplastics.com](http://www.parklandplastics.com).
6. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 PANEL SYSTEMS**

- A. Wall Panels:
  1. Panel Size: 4 by 8 feet.
  2. Panel Thickness: 0.075 inch.
  3. Surface Design: Smooth.
  4. Color: White.
  5. Attachment Method: Adhesive only, with trim and sealant in joints.

## **2.03 MATERIALS**

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
  4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
  5. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.
  6. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.
- B. Trim: Aluminum; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

### **3.02 INSTALLATION - WALLS**

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

**END OF SECTION**

**SECTION 07 05 53**  
**FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting: Paint finish.

**1.03 REFERENCE STANDARDS**

- A. CBC - California Building Code.
  - 1. Section 703.7 Marking and Identification.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
- C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.
- D. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

**1.06 FIELD CONDITIONS**

- A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.
- B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Partition Identification Labels:
  - 1. Fire Wall Signs, Inc: [www.firewallsigns.com](http://www.firewallsigns.com).
  - 2. Safety Supply Warehouse, Inc: [www.safetysupplywarehouse.com](http://www.safetysupplywarehouse.com).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of the building code.
- B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl sign with factory applied adhesive backing.
  - 1. Size: 11 by 15 inches, nominal.
  - 2. Not Less than 3 inch high letters with with minimum 3/8 inch stroke in a contrasting color.
  - 3. Suggested Text:
    - a. 1 HOUR FIRE/SMOKE BARRIER - PROTECT ALL OPENINGS AND PENETRATIONS"
- C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 91 23 for products.
- D. Languages: Provide sign markings in English.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.02 PREPARATION**

- A. See Section 09 91 23 for substrate preparation for painted markings.

### **3.03 INSTALLATION**

- A. Locate markings as required by CISPI 301 Section 703.7; measured horizontally along wall or partition.
  - 1. Place on fire walls in accessible concealed floor, floor-ceiling, or attic space above accessible ceiling.
  - 2. Within 15 feet from the end of each wall.
  - 3. Maximum interval of 30 feet.
- B. Install adhered markings in accordance with manufacturer's instructions.
- C. Install applied markings in accordance with Section 09 91 23.
- D. Install neatly, with horizontal edges level.
- E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

## **END OF SECTION**



## **SECTION 07 21 00 THERMAL INSULATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Board insulation at perimeter foundation wall and exterior wall behind plaster wall finish.
- B. Batt insulation and vapor retarder in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Batt insulation for acoustic applications in interior walls.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 27 00 - Air Barriers: Separate air barrier materials.
- B. Section 07 41 13 - Metal Roof Panels: Installation requirements for board insulation over low slope roof deck specified in this section.

#### **1.03 DEFINITIONS**

- A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
  - 1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
  - 2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
  - 3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

#### **1.04 REFERENCE STANDARDS**

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- C. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board.
- D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

- G. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
  - 1. Manufacturer and product identification for each product specified, including R-Value and fire resistance and surface burning characteristics specified herein.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Compliance Certification: Upon completion of installation of building envelope insulation, a card certifying compliance with requirements of California Code of Regulations (CCR) Title 24 for installation of insulation shall be completed, executed and delivered to local building officials, and one copy conspicuously posted at Project site.
- E. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

#### **1.06 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Fire Performance Characteristics: Where insulation is used within a fire rated wall assembly, provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, in accordance with methods specified below, by UL or other testing and inspecting agency acceptable to State Fire Marshal.
  - 1. Surface Burning Characteristics: ASTM E84.
    - a. Class A: Maximum flame-spread 0-25 and smoke developed of 0-450.
    - b. Class B: Maximum flame-spread 26-75 and smoke developed of 0-450.
    - c. Class C: Maximum flame-spread 76-200 and smoke developed of 0-450.
  - 2. Fire Resistance Ratings: ASTM E119.
  - 3. Combustibility: ASTM E136.
- B. Comply with Chapter 12-13 Standards for Insulating Materials, California Reference Standards Code (Part 12, Title 24. CCR) as published by Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation.
- C. Comply with California Energy Code:
  - 1. Section 110.8(a): Installed insulating material shall have been certified by the manufacturer to comply with the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, "Standards for Insulating Material.

2. Section 110.8(c): All Insulating Materials shall be installed in compliance with the flame spread rating and smoke density requirements of CBC Chapters 7 and 26.
3. Section 120.7(b) item 7: The opaque portions of framed demising walls in nonresidential buildings shall be insulated to meet a u-factor of:
  - a. Metal Framed Walls: Not greater than 0.151 (R-6 minimum).
- D. Certificate: As required by the California Building Code (CBC), Title 24, post a certificate containing the building permit number and the insulation manufacturer's name, material identification and R-value and stating that the insulation has been installed in accordance with the plans and specifications.
- E. Performance: Materials shall conform to Section 720, California Building Code.

## **2.02 APPLICATIONS**

- A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- B. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene (XPS) board.
- C. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.
- D. Insulation Over Roof Deck: Polyisocyanurate board.

## **2.03 FOAM BOARD INSULATION MATERIALS**

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
  1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
  2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
  5. Board Edges: Manufacturer's standard.
  6. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.
  7. Continuous Insulation at Plaster Systems: See Section 09 24 00 - Cement Plastering.
  8. Foundation Perimeter: 1-1/2 inch, R-8.
  9. Products:
    - a. Dow Chemical Company; STYROFOAM CladMate, CavityMate Ultra, or Foamular: [www.dowbuildingsolutions.com/#sle](http://www.dowbuildingsolutions.com/#sle).
    - b. Kingspan Insulation LLC; GreenGuard GG25-LG XPS Insulation Board: [www.kingspan.com/#sle](http://www.kingspan.com/#sle).
    - c. Owens Corning Corporation; FOAMULAR Type 250 Extruded Polystyrene (XPS) Insulation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.04 MINERAL FIBER BLANKET INSULATION MATERIALS**

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
  - 4. Formaldehyde Content: Zero.
  - 5. Exterior Walls: Two layers.
    - a. Thermal Resistance: Each R-value of 15. Total R-30
    - b. Thickness: Each 3-1/2 inch.
  - 6. Underside of Roof:
    - a. Thermal Resistance: R-value of 30.
    - b. Thickness: 10-1/4 inch.
  - 7. Facing: Aluminum foil, flame spread 25 rated; one side.
  - 8. Products:
    - a. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - c. Knauf Insulation: [www.knauf.com](http://www.knauf.com).
    - d. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
  - 1. Typical at interior walls, see section 09 21 16 - Gypsum Board Assemblies.
  - 2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 3. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 4. Products:
    - a. Johns Manville; MinWool Sound Attenuation Fire Batts: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. ROCKWOOL; COMFORTBATT: [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.05 ACCESSORIES**

- A. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mil, 0.012 inch thick.
  - 1. Width: 4.9 feet.
- B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
  - 1. Application: Sealing of interior circular penetrations, such as pipes or cables.
  - 2. Width: Are required for application.

3. Temperature Resistance: Range of minus 40 to 212 degrees F.
- C. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- D. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
  1. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
  2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
  3. Finish: Painted matte black at exposed interior acoustical board application.
  4. Products:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
- E. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
  1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- F. Support for Cladding and Continuous Insulation: See respective cladding section.
- G. Support for Cladding and Continuous Insulation: Thermal clips.
  1. Thermally-broken clips that provide attachment support for girts, angles, channels, and other cladding support framing.
  2. Thermal Spacer Clip: Pultruded glass fiber and thermoset polyester resin.
  3. Clip Depth: As required for thickness of insulation.
  4. Spacing of Clips: 16 inches on center, vertically.
  5. Fasteners: As recommended by clip manufacturer.
  6. Products:
    - a. Advanced Architectural Products, LLC; SMARTci GREENGirt Clips - Thermal Spacer series: [www.smartcisystems.com/#sle](http://www.smartcisystems.com/#sle).
    - b. Cascadia Windows & Doors; Cascadia Clip: [www.cascadiawindows.com/#sle](http://www.cascadiawindows.com/#sle).
    - c. Northern Facades; ISO Clip: [www.northernfacades.com/#sle](http://www.northernfacades.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Wire Mesh: Galvanized steel, hexagonal wire mesh.
- I. Protection Board for Below Grade Insulation: Cementitious, 1/4 inch thick.
- J. Adhesive: Type recommended by insulation manufacturer for application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### **3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER**

- A. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
  - 1. Tape seal joints.
  - 2. Extend sheet full height of joint.
- B. Apply adhesive to back of boards:
  - 1. Three continuous beads per board length.
  - 2. Full bed 1/8 inch thick.
- C. Install boards horizontally on foundation perimeter.
  - 1. Place boards to maximize adhesive contact.
  - 2. Install in running bond pattern.
  - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
  - 1. Apply adhesive in five continuous beads per board length.
  - 2. Install boards horizontally from base of foundation to top of insulation.
  - 3. Butt boards tightly, with joints staggered from insulation joints.

### **3.03 BOARD INSTALLATION AT EXTERIOR WALLS**

- A. Adhere 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
  - 1. Tape seal joints between sheets.
  - 2. Extend sheet full height of joint.
- B. Apply adhesive to back of boards:
  - 1. Three continuous beads per board length.
  - 2. Full bed 1/8 inch thick.
- C. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.
- D. Install boards horizontally on walls.

1. Place boards to maximize adhesive contact.
  2. Install in running bond pattern.
  3. Butt edges and ends tightly to adjacent boards and protrusions.
- E. Extend boards over expansion joints, unbonded to wall on one side of joint.
- F. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- G. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.
- H. Tape insulation board joints.

### **3.04 BOARD INSTALLATION USING CLADDING AND CONTINUOUS INSULATION SUPPORTS**

- A. Install supports in accordance with manufacturer's installation instructions.
- B. Install supports in compliance with system orientation, sizes, and locations as indicated on drawings and in accordance with approved shop drawings.
- C. Install supports to fill in exterior wall spaces without gaps or voids in insulation.
- D. Trim insulation neatly to fit spaces and provide a continuous thermal layer.

### **3.05 BATT INSTALLATION**

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Tape insulation batts in place.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member
- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.
- K. Coordinate work of this section with construction of air barrier seal, see Section 07 27 00.

### **3.06 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

### **3.07 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.

## **END OF SECTION**

## **SECTION 07 25 00 WEATHER BARRIERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Water-resistive barriers.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 27 00 - Air Barriers: Air barriers sheet and fluid applied.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

#### **1.03 DEFINITIONS**

- A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Water-Resistive Barrier: A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

#### **1.04 REFERENCE STANDARDS**

- A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- B. ASTM D779 - Standard Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- E. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

#### **1.06 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.



## **PART 2 PRODUCTS**

### **2.01 WATER-RESISTIVE BARRIER MATERIALS**

- A. Building Paper: Asphalt-saturated kraft Grade D type sheathing paper complying with ICC-ES AC38.
  - 1. Water Resistance: At least 60 minutes when tested in accordance with ASTM D779.
  - 2. Water Vapor Permeance: 29 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
  - 3. Products:
    - a. Henry Company; Super Jumbo Tex 60 Minute: [www.henry.com/#sle](http://www.henry.com/#sle).
    - b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 ACCESSORIES**

- A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
  - 1. Width: 4 inches.
  - 2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.
  - 3. Products:
    - a. DuPont de Nemours, Inc; FlexWrap: [www.dupont.com/building/#sle](http://www.dupont.com/building/#sle).
    - b. Henry Company; FortiFlash: [www.henry.com/#sle](http://www.henry.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
  - 1. Width: 3-1/2 inches.
  - 2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.
  - 3. Products:
    - a. Protecto Wrap Company; Triple Guard Energy Sill Sealer: [www.protectowrap.com/#sle](http://www.protectowrap.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Preformed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, and tear resistant.
  - 1. Products:
    - a. Dow; DOWSIL Silicone Transition Strip and System: [www.dow.com/en-us/#sle](http://www.dow.com/en-us/#sle).
    - b. Henry Company; Moistop Corner Shield: [www.henry.com/#sle](http://www.henry.com/#sle).

- c. Momentive Performance Materials, Inc/GE Silicones; RF100 Reinforcing Fabric: [www.siliconeforbuilding.com/#sle](http://www.siliconeforbuilding.com/#sle).
  - d. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - e. Tremco Commercial Sealants & Waterproofing; ProGlaze ETA System 1: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions comply with requirements of this section.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Water-Resistive Barriers: Install continuous water-resistive barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.
  - 1. At Plaster: Install two layers building paper under lath over plastic sheet per Section 07 27 00 - Air Barriers.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Exterior Sheets:
  - 1. Install sheets shingle-fashion to shed water, with seams aligned horizontal.
  - 2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
  - 3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
  - 4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
  - 5. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
  - 6. Where stud framing rests on concrete or masonry substrate, extend lower edge of barrier sheets at least 4 inches below bottom of framing and seal to substrate with sealant or approved mounting tape.
  - 7. Install water-resistive barrier over jamb flashings.

8. Install head flashings under water-resistive barrier.
  9. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
- E. Self-Adhered Sheets:
1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
  2. Lap sheets shingle-fashion to shed water and seal laps airtight.
  3. Upon placement of sheets, firmly press onto substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
  4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
  5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.
- F. Openings and Penetrations in Exterior Water-Resistive Barriers:
1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
  3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
  4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
  5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
  6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.
1. Allow access to work areas and staging.
  2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
  3. Do not cover work of this section until testing and inspection is accepted.
- C. Do not cover installed water-resistive barriers until required inspections have been completed.
- D. Obtain approval of installation procedures from water-resistive barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

- E. Envelope Water-Spray Test by Contractor: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
  - 1. Perform a minimum of two tests in each area as directed by Architect.
  - 2. Conduct tests in each area prior to 35 percent and 70 percent completion of this work.
  - 3. Testing: Installer to water test all weather barriers, storefront, windows, glazing, and door openings, in the presence of the Project Inspector (IOR) and Owner Representative by spraying with hose heavily for 5 minutes. Repair all leaks discovered by testing procedures and repeat test until leak-free performance is achieved.
- F. Take digital photographs of each portion of installation prior to covering up weather barriers.

### **3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

## **SECTION 07 27 00 AIR BARRIERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Air barriers.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Building paper under plaster applications and testing requirements.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

#### **1.03 DEFINITIONS**

- A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

#### **1.04 REFERENCE STANDARDS**

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension.
- C. ASTM D751 - Standard Test Methods for Coated Fabrics.
- D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.
- J. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
- K. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing.
- L. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Testing agency qualification statement.

### **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.
- B. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

### **1.07 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct air barrier mock-up, \_\_\_\_ feet long by \_\_\_\_ feet wide, indicating \_\_\_\_.
- C. Locate where directed.
- D. Mock-up may remain as part of work.

### **1.08 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

## **PART 2 PRODUCTS**

### **2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)**

- A. Air Barrier Sheet, Mechanically Fastened:
  - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
  - 2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
  - 3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
  - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, Class A, when tested in accordance with ASTM E84.

5. Comply with NFPA 285 requirements for wall assembly.
6. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2-1/2 inches wide, compatible with sheet material; unless otherwise indicated.
7. Products:
  - a. Certaineed, Inc.; CertaWrap Weather-Protection Membrane: [www.certaineed.com](http://www.certaineed.com).
  - b. DuPont de Nemours, Inc; Tyvek CommercialWrap D with FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: [building.dupont.com/#sle](http://building.dupont.com/#sle).
  - c. Fiberweb, Inc; Typar MetroWrap: [www.typar.com/#sle](http://www.typar.com/#sle).
  - d. Henry Company; WeatherSmart Commercial: [www.henry.com/#sle](http://www.henry.com/#sle).
  - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Air-Barrier and Water-Resistive Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M, Type X, fiberglass mat gypsum sheathing with integral weather-resistant barrier and air barrier complying with ASTM E2178 and ICC-ES AC212.
  1. Basis-of-Design Product: Georgia- Pacific Gypsum, LLC; DensElement Barrier System<sub>2</sub> or approved equal.
  2. Thickness: 5/8 inch thick.
  3. Board Type: Type X.
  4. Size: 48 by 96 inches for vertical and horizontal installation.
  5. Air- and Water-Resistive Flashing Thickness: Minimum 16-mil (0.41-mm) wet film thickness.
  6. Edges: Square.
  7. Flashing and Transition Strips: As acceptable to sheathing manufacturer.
  8. Air Permeance: Maximum 0.004 cfm/sq. ft. pressure difference when tested in accordance with ASTM E2178.
  9. Vapor Permeance: Minimum 30 perms when tested in accordance with ASTM E96/E96M, Water Method, Procedure B.
  10. Sheathing Assembly Air Leakage: Surface area maximum 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E2357.
  11. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.
  12. Combustion Characteristics; ASTM E84: Class A.
  13. Board Product Antifungal Properties; ASTM D3273: 10; zero defacement.
  14. VOC Content - Fluid-Applied Flashing: 50 g/L or less.
  15. UV and Weathering Resistance: Can be exposed to sunlight and weather for 12 months in accordance with manufacturer's written instructions.

16. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by sheathing manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
  - a. General: Provide compatible air-barrier accessory materials furnished or recommended by air-barrier manufacturer as required by Project conditions to produce a complete air-barrier assembly identical to tested assemblies meeting performance requirements.
  - b. Joint Backing: See Section 07 92 00 - Joint Sealants for backing materials.
17. Fluid-Applied Air Barrier Flashing: Site-applied for application to joints, fasteners, penetrations, openings, and material transitions.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum LLC; DensDefy Liquid Flashing, or approved equal.
  - b. Color: Gold.
18. Flashing and Transition Strip: Self-adhered membrane, 25 mils thick.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum LLC; DensDefy Transition Membrane, or approved equal.
19. Liquid-Applied Air-Barrier Membrane: Site-applied for full application to sheathing surface or CMU surfaces.
  - a. Basis-of-Design Product: Georgia-Pacific Gypsum LLC; DensDefy™ Liquid Barrier, or approved equal.

## 2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
  1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch, nominal thickness.
  2. Color: Green.
  3. Elongation: 1,300 percent, measured in accordance with ASTM D412.
  4. Peel Adhesion: 28 lb/inch, minimum, when tested in accordance with ASTM D903.
  5. Hydrostatic Head Pressure: Resists head pressure of 57 feet, maximum, when tested in accordance with ASTM D751.
  6. Comply with NFPA 285 requirements for wall assembly.
- C. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.
  1. Width: 4 inches.
  2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.



3. Products:
  - a. DuPont de Nemours, Inc; DuPont FlexWrap: [www.dupont.com/building/#sle](http://www.dupont.com/building/#sle).
  - b. DuPont de Nemours, Inc; DuPont StraightFlash: [www.dupont.com/building/#sle](http://www.dupont.com/building/#sle).
  - c. DuPont de Nemours, Inc; DuPont VersaFlange: [www.dupont.com/building/#sle](http://www.dupont.com/building/#sle).
  - d. Henry Company; FortiFlash: [www.henry.com/#sle](http://www.henry.com/#sle).
  - e. Henry Company; FortiFlex Butyl: [www.henry.com/#sle](http://www.henry.com/#sle).
  - f. Henry Company; FortiFlash Butyl: [www.henry.com/#sle](http://www.henry.com/#sle).
  - g. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- D. Thinners and Cleaners: As recommended by material manufacturer.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

#### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - On Exterior:
  1. Install sheets shingle fashion to shed water, with seams generally horizontal.
  2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
  3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
  4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
  5. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.

6. Where stud framing rests on concrete or masonry substrate, extend lower edge of air barrier sheet at least 4 inches below bottom of framing and seal to substrate with sealant or approved mounting tape.
  7. Install air barrier underneath jamb flashings.
  8. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
- E. Openings and Penetrations in Exterior Air Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
  3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
  4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
  5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.
- C. Coordination of ABAA Tests and Inspections:
  1. Provide testing and inspection required by ABAA QAP.
  2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
  3. Cooperate with ABAA testing agency.
  4. Allow access to air barrier work areas and staging.
  5. Do not cover air barrier work until tested, inspected, and accepted.
- D. Do not cover installed air barriers until required inspections have been completed.
- E. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- F. Take digital photographs of each portion of installation prior to covering up air barriers.

### **3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

## **END OF SECTION**

## **SECTION 07 41 13 METAL ROOF PANELS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Metal roof panel system of preformed steel panels. MRP-1

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 31 00 - Steel Decking: Roofing substrate.
- B. Section 07 42 13 - Metal Wall Panels: Preformed wall panels.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

#### **1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products.
- E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- G. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- J. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- K. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
- L. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
- M. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments.
- N. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Summary of test results, indicating compliance with specified requirements.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
  - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
  - 1. Include typical panel joint in sample.
  - 2. Include typical fastening detail.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- I. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

#### **1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to roof panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

#### **1.07 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide mock-up of 100 sq ft, including underlayment, eave protection membrane, and associated flashings.
- C. Locate as directed by Architect.
- D. Mock-up may remain as part of the work.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- C. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

### **1.09 FIELD CONDITIONS**

- A. Do not install metal roof panels, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

### **1.10 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.
  - 1. Installers "Leak-free" Warranty: The Manufacturer Certified Installer shall provide a "leak-free" roofing warranty in which the installer agrees to repair leaks discovered in the roofing system under the terms outlined by the roofing manufacturer within the specified warranty period.
    - a. Warranty Period: Two (2) years from date Final Inspection.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Architectural Metal Roof Panel Manufacturers:
  - 1. MRP-1 Basis of Design Product: Magna Loc as manufactured by Metal Sales Manufacturing Corp., or equal.
  - 2. AEP Span; Span-lok hp: [www.aepspan.com](http://www.aepspan.com). IAPMO ER#0309
  - 3. Berridge Manufacturing Company: [www.berridge.com/#sle](http://www.berridge.com/#sle). ICC ESR-3486
  - 4. Metal Sales Manufacturing Corp.: [www.metalsales.us.com](http://www.metalsales.us.com). ICC ESR-2385, ESR-3743
  - 5. Tremco Inc.: [Tremco.com](http://Tremco.com). ICC ESR-1166
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 PERFORMANCE REQUIREMENTS**

- A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
  - 1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed  $L/180$  of span length(L) when tested in accordance with ASTM E1592.
    - a. Dead Loads: Weight of roofing system.
    - b. Live Loads: As required by ASCE 7.
  - 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
  - 3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
  - 4. Air Infiltration: Maximum 0.06 cfm/sq ft at air pressure differential of 6.24 lbf/sq ft, when tested according to ASTM E1680.
  - 5. Water Penetration: No water penetration when tested in accordance with procedures and recommended test pressures of ASTM E1646; perform test immediately following air infiltration test.
  - 6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

## **2.03 METAL ROOF PANELS**

- A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
  - 1. Steel Panels:
    - a. Zinc-coated steel complying with ASTM A653/A653M; minimum G90 galvanizing.
    - b. Steel Thickness: Minimum 24 gauge, 0.024 inch.
  - 2. Profile: Standing seam, with minimum 1-3/4 inch seam height; concealed fastener system for field seaming with special tool.
  - 3. Texture: Smooth.
  - 4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
  - 5. Width: Maximum panel coverage of 16 inches.

## **2.04 ATTACHMENT SYSTEM**

- A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.
  - 1. Concealed Anchor Clips: Floating anchor clip, two piece.

## **2.05 FABRICATION**

- A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

## **2.06 FINISHES**

- A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat metal coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as indicated on drawings.
- B. Energy Performance:
  - 1. Energy Star Qualified: Metal panels shall meet the requirements of Energy Star Roofing Products for low or steep slope as required by application.
  - 2. Cool Roof Rating Council (CCRC)– California:
    - a. Solar Reflectance Index: Panels shall have a solar reflectance Index of not less than 78 for low-sloped roofs or 29 for steep sloped roofs as required by application

## **2.07 ACCESSORIES**

- A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
  - 1. Backing Plates: Provide metal backing plates at panel end splices fabricated from material recommended by manufacturer.
  - 2. Flashing and Trim:
    - a. Fabricate flashing and trim from same material as roof panels, minimum 0.018 inches thick. Finish to match metal roof panels.
- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or closed-cell synthetic rubber, neoprene, or PVC.
- C. Sealants:
  - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
  - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
  - 3. Seam Sealant: Factory-applied, non-skinning, non-drying type.
  - 4. Butyl Tape: Per panel manufacturer's recommendations for panel to panel and panel to trim seal.
- D. Underlayment for Wood Substrate: ASTM D226/D226M roofing felt, perforated type; covered by water-resistant rosin-sized building paper.

- E. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
  2. Sheet Thickness: 40 mil (0.040 inch) minimum total thickness.
  3. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
  4. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
  5. Water Vapor Permeance: 0.067 perm, maximum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
  6. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
  7. Liquid Water Transmission: Passes ASTM D4869/D4869M.
  8. Functional Temperature Range: Minus 70 degrees F to 240 degrees F.
  9. Products:
    - a. Basis of Design Product: VersaShield Fire Resistant Roof Deck Protection (ESR-2053) as manufactured by GAF, [www.gaf.com](http://www.gaf.com), or equal.
    - b. CETCO; Product Strong Seal SA; [www.cetco.com](http://www.cetco.com).
    - c. Henry Company; Blueskin PE200HT: [www.henry.com/#sle](http://www.henry.com/#sle).
    - d. InterWrap, Inc. Mission, BC Canada; Product Titanium-PSU-30; [www.interwrap.com](http://www.interwrap.com).
    - e. Soprema, Inc.; Product Lastobond Shield HT MU; (951) 212-4542, [www.soprema.us](http://www.soprema.us).
    - f. WR Grace; Product Grace Ultra; [www.na.graceconstruction.com](http://www.na.graceconstruction.com).
    - g. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

### **3.02 PREPARATION**

- A. Broom clean wood sheathing prior to installation of roofing system.
- B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.
- C. Coordinate installation of waterproof membrane over roof sheathing with Section 06 10 00.



- D. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.
- E. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.
- F. Protect surrounding areas and adjacent surfaces from damage during execution of this work.
- G. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

### **3.03 INSTALLATION**

- A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.
  - 1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
  - 2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, trim, moldings, closure strips, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- C. Install underlayment on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset underlayment seams.
- D. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.
  - 1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.
  - 2. Provide concealed clips at panel joints, and apply snap-on battens to provide weathertight joints.
  - 3. Provide sealant tape or other approved joint sealer at lapped panel joints.
  - 4. Install sealant or sealant tape at end laps and side joints as recommended by metal roof panel manufacturer.
- E. Insulation: Install insulation between roof covering and supporting members to present a neat appearance; fold, staple, and tape seams unless otherwise approved by Architect.
  - 1. Install batt insulation in areas concealed from view.

### **3.04 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

- B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

### **3.05 PROTECTION**

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Final Inspection.

**END OF SECTION**

## **SECTION 07 42 13 METAL WALL PANELS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Manufactured plank and profiled metal panels for walls, with related flashings and accessory components. MWP-1, MWP-2.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 40 00 - Cold-Formed Metal Framing: Wall panel substrate.
- B. Section 07 21 00 - Thermal Insulation: Exterior rigid insulation and support clips.
- C. Section 07 25 00 - Weather Barriers: Weather barrier under wall panels.
- D. Section 07 27 00 - Air Barriers: Air barrier under wall panels.
- E. Section 07 41 13 - Metal Roof Panels: Roof panels to integrate with wall panels.
- F. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- G. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- H. Section 09 21 16 - Gypsum Board Assemblies: Wall panel substrate.

#### **1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- B. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance.
- C. ASTM A606/A606M - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- F. ASTM A847/A847M - Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
  - 1. Physical characteristics of components shown on shop drawings.
  - 2. Storage and handling requirements and recommendations.

3. Installation instructions and recommendations.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.
  1. Profile.
  2. Gauge of panel.
  3. Location, layout and dimensions of panels.
  4. Location and type of fasteners.
  5. Shape and method of attachment of all trim.
  6. Locations and type of sealants.
  7. Installation sequence.
  8. Other details as may be required for a weathertight installation.
- D. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.
- E. Installer's qualification statement.
- F. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.
- G. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.
- H. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

#### **1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to wall panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
- B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.
  1. Installer shall be authorized by the manufacturer and the work shall be supervised by a person having successfully completed a manufacturer training seminar regarding proper installation of the specified product

#### **1.07 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

- B. Construct mock-up, 8 feet high by 12 feet wide; include panel system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.
- C. Locate as directed by Architect.
- D. Mock-up may not remain as part of the Work.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.
- C. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- D. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
  - 1. Store wall panel materials on dry, level, firm, and clean surface. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.
- E. Prevent contact with materials that may cause discoloration or staining of products.

#### **1.09 FIELD CONDITIONS**

- A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

#### **1.10 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
  - 1. Paint Finish: Twenty (20) years from date Substantial Completion.
- C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis of Design:
  - 1. MWP-1 Metal Wall Panels: Indicated on Drawings manufactured by BestBuy Metals.
  - 2. MWP-2 Metal Wall Panels: A606-4/A588 Flat Sheets manufactured by Western States Metal Roofing.
- B. Metal Wall Panels:
  - 1. MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.: [www.mbc.com](http://www.mbc.com)

2. Western States Metal Roofing: [www.westernstatesmetalroofing.com](http://www.westernstatesmetalroofing.com).
3. ATAS International, Inc: [www.atas.com/#sle](http://www.atas.com/#sle).
4. Berridge Manufacturing Company: [www.berridge.com/#sle](http://www.berridge.com/#sle).
5. Morin Corporation: [www.morincorp.com/#sle](http://www.morincorp.com/#sle).
6. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 METAL WALL PANEL SYSTEM**

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  1. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
  2. Design Pressure: In accordance with ASCE 7; See Project Design Criteria listed on Structural Drawings.
  3. Maximum Allowable Deflection of Panel:  $L/180$  for length(L) of span.
  4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
  5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
  7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch returns.
  8. Provide continuity of weather barrier seal at building enclosure elements in accordance with requirements; see Section 07 25 00.
  9. Provide continuity of air barrier seal at building enclosure elements in accordance with requirements; see Section 07 27 00.
- B. Exterior Wall Panels:
  1. Profile: Vertical and horizontal, as indicated; style as indicated.
  2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous bead of sealant.
  3. Material: Precoated steel sheet, 22 gauge, 0.0299 inch minimum thickness.
  4. MWP-1 Panel Width: 32 inches.
  5. Color: As indicated on drawings.
- C. Corten Exterior Wall Panels:
  1. MWP-2 Profile: Vertical and horizontal, as indicated; style as indicated.
  2. Side Seams: Batten-covered, sealed with continuous bead of sealant.
  3. Material: ASTM A606/A606M, ASTM A588/A588M (AKA Corten), As indicated on Drawings minimum thickness.
  4. Panel Width: As indicated on Drawings.
  5. Color: As indicated on drawings.

- D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
  - 1. Provide mitered internal corners, back braced with 22 gauge, 0.0299 inch thick precoated metal sheet to maintain continuity of profile.
- E. Expansion Joints: Same material, thickness and finish as exterior sheets; 20 gage, 0.032 inch thick; manufacturer's standard brake formed type, of profile to suit system.
- F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- G. Anchors: Galvanized steel.

### **2.03 MATERIALS**

- A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
- B. Weathering Steel: Corten B, ASTM A588/A588M and/or ASTM A606/A606M.
  - 1. Up to 3/16 inch: ASTM A606/A606M.
  - 2. 3/16 inch to 5 inch: ASTM A588/A588M.
  - 3. Tube: ASTM A847/A847M.
- C. Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.

### **2.04 FINISHES**

- A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.
  - 1. Basis of Design: MBCI, Signature 300, Metallic
- B. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.
  - 1. Basis of Design: MBCI, Signature 200, Metallic.

### **2.05 ACCESSORIES**

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- B. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00
- C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
  - 1. Color: To be selected by Architect.
- D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
  - 1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.
- E. Field Touch-up Paint: As recommended by panel manufacturer.
- F. Bituminous Paint: Asphalt base.

## **2.06 FABRICATION**

- A. Metal wall panels and liner panels shall be formed to lap and interconnect with edges of adjacent panels which are then mechanically attached through panel to supports using concealed fasteners.
- B. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- C. Form pieces in longest practicable lengths.
- D. Fabricate corners in one continuous piece with minimum 18 inch returns.
- E. Fabricate metal wall panels to eliminate condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- F. Panels shall be factory formed. Field formed panels are not acceptable.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that building framing members are ready to receive panels.
- B. Verify weather barrier, see Section 07 25 00, has been installed over wall panel substrate; see Section 05 40 00.
- C. Verify air barrier, see Section 07 27 00, has been installed over wall panel substrate; see Section 05 40 00.
- D. Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

### **3.02 PREPARATION**

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

### **3.03 INSTALLATION**

- A. Install panels on walls and soffits in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.
- C. Cutting and fitting of panels shall be neat, square and true. Torch cutting is prohibited.
- D. Fasten panels to structural supports; aligned, level, and plumb.
- E. Locate joints over supports.
- F. Trim Installation: Apply sealant tape at trim, per manufacturer's details and approved shop drawings, for weathertight installation.
- G. Provide expansion joints where indicated or required.
- H. Use concealed fasteners unless otherwise indicated by Architect.
- I. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.
- J. Sealant Installation for Exposed Joints:
  - 1. Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.



2. Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.

#### **3.04 TOLERANCES**

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch, maximum.
- B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch, maximum.

#### **3.05 CLEANING**

- A. Remove protective film immediately after installation.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Remove site cuttings from finish surfaces.
- D. Touch-up, repair or replace metal panels and trim that have been damaged.
- E. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

**END OF SECTION**

## **SECTION 07 46 46 FIBER-CEMENT SIDING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Fiber-cement siding.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Water-resistive barrier under siding.
- B. Section 09 21 16 - Gypsum Board Assemblies: Siding substrate.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
  - 1. Manufacturer's requirements for related materials to be installed by others.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.
  - 4. Installation methods, including nail patterns.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
  - 1. Details for each corner and end condition.
- D. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- H. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified in this section with not less than three years of experience.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
- C. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

## **1.07 FIELD CONDITIONS**

- A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

## **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.
- C. Manufacturer Warranty: Provide manufacturer warranty for years as indicated under Fiber-Cement Siding article sub-headings for "Warranty". Complete forms in Owner's name and register with manufacturer.

# **PART 2 PRODUCTS**

## **2.01 FIBER-CEMENT SIDING**

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
  - 1. Style: Standard lap style.
  - 2. Texture: Simulated cedar grain.
  - 3. Length: 12 feet, nominal.
  - 4. Width (Height): 5-1/4 inches.
  - 5. Thickness: 5/16 inch, nominal.
  - 6. Finish: Factory applied topcoat.
  - 7. Color: As indicated on drawings.
  - 8. Warranty: 30 year limited; transferable.
  - 9. Products:
    - a. Basis of Design Product: Vintage Wood AWP 1818 as manufactured by Nichiha USA, Inc, or approved equal.
    - b. Allura, a division of Plycem USA, Inc: [www.allurausa.com/#sle](http://www.allurausa.com/#sle).
    - c. James Hardie Building Products, Inc: [www.jameshardie.com/#sle](http://www.jameshardie.com/#sle).
    - d. Nichiha USA, Inc: [www.nichiha.com/#sle](http://www.nichiha.com/#sle).
    - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

- B. Soffit Panels: Smooth panels of same material and finish.

## **2.02 ACCESSORIES**

- A. Furring Strips, Metal: Galvanized metal channels. Minimum 3/8 inch.
- B. Trim: Same material and texture as siding.
- C. Metal Trim: Extruded aluminum alloy 6063-T5 temper.
  - 1. Finish: Clear anodized.
  - 2. Color: As selected by Architect.
- D. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches, minimum.
- E. Exterior Soffit Vents: One piece, perforated, ASTM A653/A653M galvanized steel with G90 coating, with edge suitable for direct application to gypsum board and manufactured especially for soffit application, and provide continuous vent.
- F. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.
- G. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that water-resistant barrier has been installed over substrate completely and correctly; see Section 07 25 00.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Protect surrounding areas and adjacent surfaces during execution of this work.
- B. Install Sheet Metal Flashing:
  - 1. Above door and window trim and casings.
  - 2. Above horizontal trim in field of siding.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and recommendations.
  - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
  - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
  - 3. Use trim details as indicated on drawings.

4. Touch up field cut edges before installing.
  5. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.
  - C. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least three screws penetrating each stud the panel crosses and at panel ends.
  - D. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
  - E. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
  - F. Do not install siding less than 6 inches from ground surface, or closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.
  - G. Exterior Soffit Vents: Install in accordance with manufacturer's written instructions and at locations indicated on drawings; provide vent area as indicated on drawings.
  - H. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
  - I. Finish Painting: Within one week after installation, paint siding and trim with one coat primer and two coats finish paint.

#### **3.04 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean faced panels in accordance with manufacturer's maintenance instructions, using cleaning materials and methods acceptable to manufacturer.

#### **3.05 PROTECTION**

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

### **END OF SECTION**

**SECTION 07 62 00**  
**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 06 10 00 - Rough Carpentry: Field fabricated roof curbs.
- C. Section 07 25 00 - Weather Barriers: Flexible flashing.
- D. Division 7 - Thermal and Moisture Protection: Roofing system.
- E. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.
- F. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.
- G. Section 09 91 13 - Exterior Painting: Field painting.

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 1. Use 2015 as indicated in 2019 CBC Referenced Standards.
- D. ASTM B32 - Standard Specification for Solder Metal.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 1. Use 2014 as indicated in 2019 CBC Referenced Standards.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - 1. Use 2014a as indicated in 2019 CBC Referenced Standards.
- G. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  - 1. Use 2015a as indicated in 2019 CBC Referenced Standards.
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

- I. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method).
  - 1. Use 2015 as indicated in 2019 CBC Referenced Standards.
- J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
- K. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
  - 1. Use 2007(2012)e1 as indicated in 2019 CBC Referenced Standards.
- L. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- M. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 6 x 6 inch in size illustrating metal finish color.

#### **1.06 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

### **PART 2 PRODUCTS**

#### **2.01 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239 inch) thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
  - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
  - 2. Color: As selected by Architect from manufacturer's custom colors.

## **2.02 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
  - 1. Coping and Cap Flashing:
    - a. Coping and caps of type and profile indicated on Drawings, 20 gage galvanized sheet metal, with integral expansion.
  - 2. Drips at Doors and Windows:
    - a. Provide 20 gage galvanized sheet metal drips at head of all exterior doors and windows where no roof or overhang protection occurs.
    - b. Extend drips 2 inches beyond jambs, unless noted otherwise.
- B. Fabricate cleats of same material as sheet, minimum 4 inches wide, except at continuous strips, interlocking with sheet.
  - 1. Typically use continuous strips.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
  - 1. Typical Seams: Overlapped and sealed seams.
  - 2. Coping Seams: Lock seams, flattened.
  - 3. Seams, Horizontal to Vertical Transitions: Solder joints.
  - 4. Soldered seams: Tin edges to be seamed, form seams, and solder.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

## **2.03 GUTTER AND DOWNSPOUT FABRICATION**

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Profile as indicated.
  - 1. Steel Pipe Downspouts: See section 05 50 00 - Metal Fabrications.
    - a. Provide steel pipe downspouts where indicated. Fabricate from galvanized, Schedule 40 steel pipe or tube of sizes indicated. Weld joints and grind smooth. Shop prime with zinc-rich primer for field painting.
    - b. Provide necessary transitions from steel pipe to gage metal roof gutters and gutter outlets.
    - c. Hold downspouts in position 1 inch clear of walls with galvanized steel straps at spacing indicated, securely fastened to wall.
      - 1) Provide heavy duty mounting bracket hardware for attachment to structural steel.



- C. Scuppers and Overflows: 24 gage galvanized sheet metal, as indicated on Drawings and complying with referenced SMACNA Manual Figure number. Fabricate with minimum 6 inch flanges.
- D. Gutters and Downspouts: Size indicated.
- E. Accessories: Profiled to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
  - 2. Gutter Supports: Straps.
  - 3. Downspout Supports: Straps.
  - 4. Strainers 10 gage galvanized steel wire basket type, riveted and soldered into place.
- F. Splash Pans: Same metal type as downspouts, formed to 12 x 18 inches size; rolled sides of 1 inch high for inverted pan placement.
- G. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- H. Downspout Boots: Steel.
- I. Downspout Extenders: Same material and finish as downspouts.
- J. Seal metal joints.

#### **2.04 EXTERIOR PENETRATION FLASHING PANELS**

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- B. Basis of Design Product: Quickflash Weatherproofing Flashing Panels as manufactured by Quickflash Weatherproofing Products, Inc., [www.quickflashproducts.com](http://www.quickflashproducts.com), or equal.
- C. Coordinate with each trade to provide specific models correctly sized for each individual pipe, duct, conduit, box, or panel penetration in each application as occurs in the building envelope.
- D. Plumbing Flashing Panels:
  - 1. Materials:
    - a. Panel: Combination of high-density polyethylene (HDPE) and low-density polyethylene (LDPE).
      - 1) HDPE, Specific Gravity, ASTM D1505: 0.953 g/cm<sup>3</sup>.
      - 2) HDPE, Tensile Strength at Yield, ASTM D638: 3,100 psi.
      - 3) LDPE, Specific Gravity, ASTM D792: 0.917 g/cm<sup>3</sup>.
      - 4) LDPE, Tensile Strength at Yield, ASTM D638: 1,300 psi.
    - b. Weatherproof Seal: Thermoplastic elastomer.
      - 1) Hardness, ASTM D2240, Shore A, 10 Seconds: 46.
      - 2) Specific Gravity, ASTM D792: 1.05 g/cm<sup>3</sup>.
      - 3) Tensile Strength, ASTM D412: 490 psi.
- E. Electrical Flashing Panels:
  - 1. Material: Thermoplastic elastomer.

- a. Hardness, ASTM D2240, Shore A, 10 Seconds: 93.
- b. Specific Gravity, ASTM D792: 1.05 g/cm<sup>3</sup>.
- c. Tensile Strength, ASTM D412: 1,300 psi.

## 2.05 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Miscellaneous Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of the Work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.
- C. Underlayment: Self-adhesive sheet flexible flashing complying with ASTM D1970/D1970M.
  - 1. Adhesives: Type recommended by flexible flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- D. Slip Sheet: Rosin sized building paper.
- E. Primer: Zinc chromate type.
- F. Concealed Sealants: Non-curing butyl sealant.
- G. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
  - 1. Epoxy Seam Sealer: 2-part non-corrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
- H. Plastic Cement: ASTM D4586/D4586M, Type I.
- I. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.
  - 1. Reglets:
    - a. Surface-applied, Fry Springlok Flashing System Type SM, or equal.
    - b. Recessed, Fry Springlok Flashing System Type ST, or equal.
  - 2. Performance Requirements
    - a. Reglet and flashing manufacturer shall certify that the system to be installed has been tested to resist 110 MPH wind loads when tested in accordance with ASTM D3161/D3161M for a minimum period of two hours.
  - 3. Specified Manufacturer: Fry Reglet Corporation, [www.fryreglet.com](http://www.fryreglet.com).
  - 4. Acceptable Manufacturers:
    - a. O'Keefes, Inc., [www.okeefes.com](http://www.okeefes.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
  - 5. Reglets and Flashing, General: Springlok Flashing, as manufactured by Fry Reglet Corporation, or equal, formed metal reglet with snap-in metal counter-flashing, factory-fabricated, with a minimum opening of 1/4 inch and a depth of 1-1/4 inches.
    - a. Reglet material: 24 gage galvanized steel.
    - b. Flashing material: 0.020 inch Type 302 stainless steel.
    - c. End laps: Factory-formed, 1 inch at reglets and 3 inches at flashings.

- d. Corners: Provide built-up mitered corner pieces for internal and external angles.
  - e. Wind clips: Provide Fry Windlok Clip, sheet metal clips to be secured to wall prior to installing flashing in reglet, and to be bent up over bottom edge of flashing.
- 6. Accessories:
  - a. Corners: Factory-manufactured, mitered inside and outside corners.
  - b. Splices: Factory-manufactured, integral component of reglet and flashing system.
- J. Solder: ASTM B32; Sn50 (50/50) type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.03 INSTALLATION**

- A. Conform to drawing details and the following:
  - 1. Scuppers: SMACNA Architectural Sheet Metal Manual, Detail 1-26 through 1-28, 1-30B.
  - 2. Downspouts: SMACNA Architectural Sheet Metal Manual, Detail 1-32B, 1-32F, 1-35B.
  - 3. Parapet Coping/Cap: SMACNA Architectural Sheet Metal Manual, Detail 3-1, 3-3(18 Butt Seam w/ backing plates).
  - 4. Roof - Penetration Flashing: SMACNA Architectural Sheet Metal Manual, Detail 4-13 through 4-16.
- B. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
  - 1. Counterflashings Installation: Install counterflashing in reglets to form tight fit, either by snap-in seal arrangement or by securing in place with lead wedges spaced 18 inches on center maximum. Pack remaining spaces with lead wool.

- a. Except where indicated or specified otherwise, insert counterflashing in reglets, extending down vertical surfaces over upturned vertical leg of base flashings not less than 3 inches.
  - b. Form counterflashings to required shapes before installation.
  - c. Lengths of metal counterflashings shall not exceed 120 inches.
  - d. Where stepped counterflashings are required, counterflashing may be installed in short lengths or may be of the preformed one-piece type.
  - e. Provide factory- or shop-form corners not less than 12 inches from the angle.
  - f. Provide end laps in counterflashings not less than 3 inches and make laps weathertight with sealant.
  - g. Turn up concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inches into wall.
  - h. Fold exposed edges of counterflashings 1/2 inch.
  - i. Install counterflashing to provide a spring action against base flashing.
- 2. Thru-Wall Flashing:
  - a. Start flashing 1/2 inch behind exposed face of wall and extend through wall.
  - b. Lap-seam joints and seal with sealant.
  - c. Provide sealant around penetrations through flashing.
- F. Seal metal joints watertight.
- G. Secure gutters and downspouts in place with concealed fasteners.
  - 1. Install downspouts not less than 1 inch clear from walls.
  - 2. Fasten downspouts to walls at top, bottom, and at an intermediate point not exceeding 60 inches on center, with leader straps or concealed rack-and-pin type fasteners.
- H. Connect downspouts to downspout boots, and grout connection watertight.
- I. Set splash pans under downspouts. Set in place with adhesive .
- J. Scuppers and Overflows Installation:
  - 1. Mechanically fasten and solder joints.
  - 2. Fold outside edges under 1/2 inch on all sides.
  - 3. Join the bottom edge to closure flange, where necessary, and form ridge to act as a gravel stop around scupper inlet.
  - 4. Coat interior of scuppers and overflows with bituminous plastic cement.
- K. Metal Flashing at Wall and Roof Penetrations and Equipment Supports:
  - 1. Exception:
    - a. Roofing: Where single ply system assembly has provided flashing for penetrations.
  - 2. Penetrations through Single Ply (ex; PVC or TPO) membrane:
    - a. Roofing contractor is to install Single Ply (ex; PVC or TPO) cones and or flashing per roofing manufacturers standard details.

- b. Roofing contractor is to provide sealant and stainless draw band to seal Single Ply (ex; PVC or TPO) cones and or flashings in accordance with the roofing manufacturer's standard details.
- 3. Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck or walls.
  - a. Goose-necks, rainhoods, power roof ventilators, and other plumbing, HVAC and electrical products are specified as appropriate in:
    - 1) Division 21 - Fire Suppression.
    - 2) Division 22 - Plumbing.
    - 3) Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC).
    - 4) Division 26 - Electrical.
  - b. Coordinate also with sheet metal curbs specified in Section 07 72 00.
- 4. Single Pipe Vents: Provide lead flashing as indicated on Drawings.
  - a. Set flange of sleeve in bituminous plastic cement and nail 3 inches on centers.
  - b. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inches.
  - c. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed galvanized sheet metal housing.
  - d. Set metal housing with a metal sleeve having a 4 inch roof flange in bituminous plastic cement and nailed 3 inches on center.
  - e. Extend sleeve a minimum of 8 inches above the roof deck and lapped a minimum of 3 inches by a metal hood secured to the vent pipe by a draw band.
  - f. Seal the area of hood in contact with vent pipe with specified sealant. Sealants are specified in Section 07 92 00 - Joint Sealants.
- 5. Roof Penetration Flashing:
  - a. Base Flashing:
    - 1) Extend flange onto roof 6 inches minimum away from penetration.
    - 2) Extend flange upward around penetration to at least 8 inches above roofing felts.
    - 3) Fold back upper and side roof flange edges 1/2 inch minimum.
    - 4) Lap and solder joints.
  - b. Counterflashing: Overlap base flashing 1 inch minimum with storm collar sloped away from penetration. Secure to penetration with draw band and sealant.
- 6. Equipment Support and Pad Flashing:
  - a. Fully cap support and pad.
  - b. Overlap base flashing 4 inches.
  - c. Lap and solder joints.
  - d. Provide sealant around penetrations through-flashing.

### **3.04 CLEANING AND PREPARATION FOR FIELD PAINTING**

- A. Metal Preparation: As sheet metal installation progresses, neutralize excess flux with 5 to 10 percent washing soda solution, and thoroughly rinse.
- B. Repairs: Repair or replace damaged and deformed sheet metal.
- C. Cleaning: Wash down exposed surfaces and remove stains, scrap and debris such that sheet metal is ready to receive field painting and related Work.
  - 1. Wash down exposed surfaces and remove soiling, dust, contamination from steel wool and drilling residue, and other scrap and debris.
  - 2. Scrub surfaces with detergent solution as necessary to remove grease and oil films, handling marks, and stains.

### **3.05 FIELD PAINTING**

- A. Field Painting: Field-paint exposed sheet metal for corrosion resistance and decorative purposes. Field finish painting is specified in Section 09 91 13 - Exterior Painting.

### **3.06 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

### **3.07 SCHEDULE**

- A. Fascia and Cornices: Prefinished.
- B. Gutters and Downspouts: Prefinished to match adjacent wall color.
- C. Scuppers: Thermoplastic membrane cladding, when adjacent to and a part of the roofing.
- D. Coping, Cap, Parapet, Sill and Ledge Flashings: Thermoplastic membrane cladding, when adjacent to and a part of the roofing.
- E. Flashings Associated with Roofing Tiles, including Valley, Hip, Ridge, Eave, Gutter Edge, Gable Edge, Chimney: Pre-finished
- F. Sheet Metal Roof Expansion Joint Covers, and Roof-to-Wall Joint Covers: Pre-finished to match adjacent wall color.
- G. Counterflashings at Roofing Terminations (over roofing base flashings): Thermoplastic membrane cladding.
- H. Counterflashings at Curb-Mounted Roof Items: Exposed galvanized, when behind a parapet; pre-finished otherwise
- I. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: Exposed galvanized, when behind a parapet; pre-finished otherwise.

### **END OF SECTION**

## **SECTION 07 72 00 ROOF ACCESSORIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Non-penetrating pedestals.
- B. Roof snow and ice melting system.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications.
- B. Division 7 - Thermal and Moisture Protection: Roofing System

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. OSHA 29 CFR 1910.23 - Fall Protection in General Industry.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
  - 1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
  - 2. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
  - 3. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in California.
- D. Warranty Documentation:
  - 1. Submit manufacturer warranty.
  - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

### **1.05 QUALITY ASSURANCE**

- A. Pre-Installation Conference: Participate in conference with insulation and built-up roofing manufacturer and applicator as required in roofing section.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES**

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
  - 1. Design Loadings and Configurations: As required by applicable codes.
  - 2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
  - 3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - 5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
  - 6. Products:
    - a. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; S-5! Utility System: [www.s-5.com/#sle](http://www.s-5.com/#sle).
    - b. PHP Systems/Design: [www.phpsd.com](http://www.phpsd.com).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
  - 1. Bases: High density polypropylene.
  - 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - 4. Products:
    - a. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; S-5! Utility System: [www.s-5.com/#sle](http://www.s-5.com/#sle).



- b. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 SNOW GUARDS**

- A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and metal trim to match roof.
  - 1. Brackets: Stainless steel.
  - 2. Pipe or Square Tube: Powder coating with color to match roof.
    - a. Outside Diameter, Round: 1 inch, nominal.
    - b. Threaded Couplings: Match pipe or tube, manufacturers standard.
    - c. Sleeve Couplings: Manufacturer's standard material.
    - d. End Collars and Caps: Metal to match tube.
  - 3. Supplemental Plates and Clips: Attached to horizontal component; match finish of pipe, tube, rod, or channel.
- B. Clamps for Standing Seam Roof: Stainless steel clamps attached to standing seams of roof panels; for attachment of fence type snow guard.
  - 1. Seam Profile: Selected by Architect from manufacturer's standard range; match profile of metal roof.
  - 2. Finish: Powder coating with color to match roof.
- C. Bracket Base Plate: Shaped to fit roof tile, with integral sealant pocket and factory applied sealant; match bracket material.
  - 1. Finish: Powder coating with color to match roof.
- D. Products:
  - 1. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; DualGard: [www.s-5.com/#sle](http://www.s-5.com/#sle).
  - 2. Rocky Mountain Snow Guards, Inc; No-Flash 2 Pipe or 3 Pipe Snow Fence Bracket: [www.rockymountainsnowguards.com/#sle](http://www.rockymountainsnowguards.com/#sle).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 ROOF SNOW AND ICE MELTING SYSTEMS**

- A. Roof Snow and Ice Melting Systems: Self-regulating heating cable system for roof and gutter applications to melt snow and ice.
  - 1. Application: Shingle roofing system with gutter.
  - 2. Provide cable spacing and number of heating circuits and accessories in accordance with manufacturer's written requirements.
  - 3. Cable: Nickel-plated copper bus wires with radiation cross-linked polyolefin heating core and primary dielectric insulation, copper metallic braid, and polyolefin outer cover.
  - 4. Supply Voltage: 110-120 VAC with ground-fault protection as required by authorities having jurisdiction (AHJ).
  - 5. Power Output: 12 W/linear ft, nominal, of cable length in snow and ice at 32 degrees F.
  - 6. Products:
    - a. Thermon, Inc: [www.thermon.com/#sle](http://www.thermon.com/#sle).

- b. Substitutions: See Section 01 60 00 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.
- B. Operational Units: Test and operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

#### **3.04 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean installed work to like-new condition.

#### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

## **SECTION 07 84 00 FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 01 70 00 - Execution and Closeout Requirements: Cutting and patching.
- C. Section 07 05 53 - Fire and Smoke Assembly Identification.
- D. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 1. Use 2016 as indicated in 2019 CBC Referenced Standards.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
  - 1. Use 2013A as indicated in 2019 CBC Referenced Standards.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
  - 1. Use 2015 as indicated in 2019 CBC Referenced Standards.
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.
  - 1. Use 2014b as indicated in 2016 CBC Referenced Standards.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
  - 1. Use 2010a(2015) as indicated in 2019 CBC Referenced Standards.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus.
  - 1. Use 2015b as indicated in 2019 CBC Referenced Standards.
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- H. CBC - California Building Code.
- I. ITS (DIR) - Directory of Listed Products.
- J. FM 4991 - Approval Standard of Firestop Contractors.
- K. FM (AG) - FM Approval Guide.
- L. Firestop Contractors International Association (FCIA): M.O.P. Manual of Practice.

- M. International Firestop Council (IFC); [www.firestop.org](http://www.firestop.org):
  - 1. Reference 1: Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments.
  - 2. Reference 2: Inspectors Pocket Guide; Fifth Edition.
- N. SCAQMD 1168 - Adhesive and Sealant Applications.
- O. UL 1479 - Standard for Fire Tests of Penetration Firestops.
  - 1. Use 2003 as indicated in 2019 CBC Referenced Standards.
- P. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.
  - 1. Use 2004 as indicated in 2019 CBC Referenced Standards.
- Q. UL (DIR) - Online Certifications Directory.
- R. UL (FRD) - Fire Resistance Directory.
- S. UL 263 - Standard for Fire Tests of Building Construction and Materials.
  - 1. Use 2011 as indicated in 2019 CBC Referenced Standards.
- T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
  - 1. Use 2008 as indicated in 2019 CBC Referenced Standards.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Certificate from authority having jurisdiction indicating approval of materials used.
- H. Installer Qualification: Submit qualification statements for installing mechanics.

#### **1.05 QUALITY ASSURANCE**

- A. Provide products for all trades from the same manufacturer to the greatest extent possible and from the same supplier/distributor.
- B. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
  - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
  - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
  - 1. One firestop manufacturer shall be used for the entirety of applications on this project unless otherwise approved by the Architect. The manufacturer will be required to furnish UL tested systems for all applications pertaining to the project, and other relevant information.
    - a. Materials of different manufacture than allowed by the tested and listed system shall not be intermixed in the same firestop system or opening.
    - b. Tested and listed firestop systems are to be used before an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRRA) is installed.
  - 2. A manufacturer's knowledgeable direct representative (manufacturer authorized; distributor, independent representative, manufacturer's representative, or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- D. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Trained by manufacturer.
  - 2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
    - a. UL Qualified Firestop Contractor
    - b. Verification of minimum three years documented experience installing work of this type.
    - c. Shown to have successfully completed not less than 5 comparable scale projects.
    - d. Verification of at least five satisfactorily completed projects of comparable size and type.
    - e. Firestop Contractors International Association Contractor Member in good standing.
    - f. Licensed by local authorities having jurisdiction (AHJ).

#### **1.06 SEQUENCING AND SCHEDULING**

- A. Project coordination is essential to inform and educate all the parties involved with the firestopping process of their role and how they can affect firestopping on the project. A pre-construction meeting shall be scheduled and required for all parties involved prior to the start of construction.
- B. Do not cover up firestopping installations until Owner's inspection agency or the Authorities Having Jurisdiction have examined each installation.

#### **1.07 MOCK-UP**

- A. Install one firestopping assembly representative of each fire rating design required on project.
  - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- B. Obtain approval of authorities having jurisdiction (AHJ) before proceeding.

- C. If accepted, mock-up will represent minimum standard for the Work.
- D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

## **1.08 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Firestop System installation must meet requirements of ASTM E814, ASTM E2307, ASTM E1966, UL 263, UL 723, and UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
  - 1. Positive pressure in accordance with California Building Code (CBC) for ratings. Reference: CBC Section 714.4.1.2.
  - 2. Comply with UL 2079 for top of wall assemblies.
  - 3. Conform to CBC Section 714.4.1.1 and 714.4.2.
- B. For those firestop applications that exist for which no UL tested system is available through any manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

### **2.02 MANUFACTURERS**

- A. Firestopping Manufacturers:
  - 1. Basis of Design: Specified Technologies, Inc: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
  - 2. 3M Fire Protection Products: [www.3m.com/firestop/#sle](http://www.3m.com/firestop/#sle).
  - 3. A/D Fire Protection Systems Inc: [www.adfire.com/#sle](http://www.adfire.com/#sle).
  - 4. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 5. Nelson FireStop Products: [www.nelsonfirestop.com/#sle](http://www.nelsonfirestop.com/#sle).
  - 6. Rectorseal; Bio FireShield and Metacaulk Systems: [www.rectorseal.com](http://www.rectorseal.com).
  - 7. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 8. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.03 MATERIALS**

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

- C. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E. Fire Ratings: Refer to drawings for required systems and ratings.

#### **2.04 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
  - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
  - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
  - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

#### **2.05 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS**

- A. Gypsum Board Walls:
  - 1. Top of Wall Joints at Underside of Non-Rated Metal Deck Metal Deck Roof, Wall Parallel and Perpendicular to Ribs, Not Cut to Fit:
    - a. 1 and 2 Hour Construction, fluted metal deck: Class II Movement; 50 or 75% compression: UL System HW-D-0499 (Similar); Mineral Wool over top track with intumescent strip affixed to both sides; BlazeFrame see section 09 22 16 - Non-Structural Metal Framing.
  - 2. Top of Wall Joints at Underside of Steel Beam with Sprayed On Fireproofing and Non-Rated Metal Deck Roof:
    - a. 1 and 2 Hour Construction, fluted metal deck: Class II/III Movement; 100% compression: UL System HW-D-0502 (Similar); with intumescent strip affixed to both sides; BlazeFrame see section 09 22 16 - Non-Structural Metal Framing.
    - b. 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
    - c. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
  - 3. Top of Wall Joints adjacent to Steel Beam with Sprayed On Fireproofing and Non-Rated Metal Deck Roof:
    - a. 1 and 2 Hour Construction, fluted metal deck: Class II/III Movement; 100% compression: UL System HW-D-0501 (Similar); Mineral Wool over top track with intumescent strip affixed to both sides; BlazeFrame see section 09 22 16 - Non-Structural Metal Framing.
  - 4. Top of Wall Joints at Concrete Over Metal Deck:
    - a. 2 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
  - 5. Top of Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:

- a. 1 and 2 Hour Wall Construction, UL System HW-D-0099; 2-1/2 inch concrete floor over fluted metal deck, includes beam penetration: Class II Movement; 50 and 100% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - b. 1 and 2 Hour Wall Construction, UL System HW-D-0137; 2-1/2 inch concrete floor over fluted metal deck, includes beam penetration: Class II Movement; 50% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - c. 1 and 2 Hour Wall Construction, UL System HW-D-0153; 2-1/2 inch concrete floor over fireproofed fluted metal deck, includes beam penetration: Class II Movement; 19% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - d. 1 and 2 Hour Wall Construction, UL System HW-D-0365; 2-1/2 inch concrete floor over fluted metal deck, includes beam penetration: Class II Movement; 40, 50 or 100% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - e. 1 and 2 Hour Wall Construction offset from deck flute, UL System HW-D-0456; 2-1/2 inch concrete floor over fluted metal deck: Class II Movement; 50 or 100% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - f. 1 and 2 Hour Shaft Wall Construction offset from deck flute, UL System HW-D-0644; 2-1/2 inch concrete floor over fluted metal deck: Class II Movement; 50 or 100% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - g. 1 and 2 Hour Wall Construction, UL System HW-D-1074; 2-1/2 inch concrete floor over fluted metal deck: Class II Movement; 25% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
6. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
- a. 1, 2, 3, and 4 Hour Wall Construction, UL System HW-D-0043; 2-1/2 inch concrete fill over fluted metal deck: Class II Movement; 40 or 50% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - b. 1 and 2 Hour Wall Construction, UL System HW-D-0088; 2-1/2 inch concrete fill over fireproofed fluted metal deck: Class II Movement; 19% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - c. 1 and 2 Hour Wall Construction, UL System HW-D-0136; 2-1/2 inch concrete fill over fluted metal deck: Class II Movement; 19% compression: mineral wool packing with SpecSeal AS200 Elastomeric Spray.
  - d. 1 and 2 Hour Wall Construction, UL System HW-D-0363; 2-1/2 inch concrete fill over fluted metal deck: Class II Movement; 100% compression: mineral wool packing with SpecSeal Speed Flex Joint Profile and SpecSeal AS200 Elastomeric Spray.
  - e. 1 and 2 Hour Wall Construction offset maximum 6 inches from steel beam, UL System HW-D-0377; 2-1/2 inch concrete fill over fireproofed fluted metal deck: Class II Movement; 12.5 or 50% compression: mineral wool packing closure to beam with SpecSeal AS200 Elastomeric Spray.
  - f. 1 and 2 Hour Shaft Wall Construction offset maximum 6 inches from steel beam, UL System HW-D-0643; 2-1/2 inch concrete fill over fireproofed fluted metal deck: Class II Movement; 12.5% compression: mineral wool packing closure to beam with SpecSeal AS200 Elastomeric Spray.



7. Top of Shaft Wall Joints at Concrete Over Metal Deck, Wall Parallel and Perpendicular to Ribs, Not Cut to Fit:
  - a. 1 and 2 Hour Shaft Wall Construction, 2-1/2 inch concrete fill over fluted metal deck: Class II Movement; 50 or 100% compression: UL System HW-D-0548; mineral wool packing with SpecSeal Speed Flex Joint Profile and SpecSeal AS200 Elastomeric Spray.
  - b.

## **2.06 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION**

- A. Penetrations Through Floors or Walls By:
  1. Multiple Penetrations in Large Openings:
    - a. 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - b. 2 Hour Construction: UL System C-AJ-8055; Specified Technologies Inc. SSP Firestop Putty.
  2. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction, 2-1/2 inch minimum concrete: UL System C-AJ-1353; F Rating: 3 Hour; SpecSeal LCI Sealant, optional steel sleeve.
    - b. 2 Hour Construction, 4-1/2 inch minimum concrete: UL System C-AJ-1616; F Rating: 2 Hour; SpecSeal LCI Sealant, optional steel sleeve.
  3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction, 4-1/2 inch minimum concrete: UL System C-AJ-2031; F Rating: 3 Hour; T Rating: 2 Hour; SpecSeal LCI Sealant.
    - b. 2 Hour Construction, 4-1/2 inch minimum concrete: UL System C-AJ-2064; F Rating: 2 & 3 Hour; T Rating: 2 & 3 Hour; SpecSeal BLU Wrap Strip.
    - c. 2 Hour Construction, 2-1/2 inch minimum concrete: UL System C-AJ-2166; F Rating: 2 Hour; T Rating: 0 & 1 Hour; SpecSeal RED2 Wrap Strip.
    - d. 2 Hour Construction, 4-1/2 inch minimum concrete: UL System C-AJ-2574; F Rating: 2 Hour; T Rating: 0 Hour; SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, Pensil 300 Sealant or SpecSeal Series SIL300 Sealant for floors or walls and Pensil 300 S/L Sealant or SpecSeal Series SIL300SL Sealant for floors only, optional steel sleeve.
    - e. 2 Hour Construction, 4-1/2 inch minimum concrete: UL System C-AJ-2576; F Rating: 2 Hour; T Rating: 1/4 Hour; SpecSeal Series SSS Sealant or SpecSeal LCI Sealant, optional steel sleeve.
  4. Electrical Cables Not In Conduit:
    - a. 2 Hour Construction, UL System C-AJ-3128; 4-1/2 inch minimum concrete: F Rating: 3 Hour; T Rating: 0 Hour; SpecSeal 100, 101, 102 or 105 Sealant, optional steel sleeve.
    - b. 2 Hour Construction with EZ Path, UL System C-AJ-3260; 4-1/2 inch minimum concrete: F Rating: 2 Hour; T Rating: 0 and 1/2 Hour; Firestop Device: EZ PATH Series 44+ Fire Rated Pathway, optional steel sleeve.

- 1) When cable fill within the device is min 0 percent (empty) to max 20 percent, the T, FT and FTH Ratings are 0 Hr. When cable fill within the device is greater than 20 percent, the T, FT and FTH Ratings are 1/2 Hr.
5. Cable Trays with Electrical Cables:
  - a. 3 Hour Construction: UL System C-AJ-4029; Specified Technologies Inc. SSB Intumescent Firestop pillows.
  - b. 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.
6. Insulated Pipes:
  - a. 2 Hour Construction, UL System C-AJ-5029; 4-1/2 inch minimum concrete: F Rating: 3 Hour; T Rating: 1 Hour; SpecSeal 100, 101, 102 or 105 Sealant.
  - b. 2 Hour Construction, UL System C-AJ-5112; 4-1/2 inch minimum concrete: F Rating: 1-1/2 Hour; T Rating: 3/4 Hour; SpecSeal 100, 101, 102 or 105 Sealant, optional steel sleeve.
- B. Penetrations Through Floors By:
  1. Multiple Penetrations in Large Openings:
    - a. 2 Hour Construction, UL System C-AJ-8053; 4-1/2 inch minimum concrete: F Rating: 2 Hour; T Rating: 0, 1/4, 1/2, 3/4 and 1-1/2 Hour; SpecSeal Series SSS Sealant or SpecSeal LCI Sealant over mineral wool packing.
  2. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System F-A-2065; Hilti CP 680-P Cast-In Device.
    - b. 2 Hour Construction, 2-1/2 inch minimum concrete: UL System F-A-2077; F Rating: 2 Hour; T Rating: 0 Hour; SpecSeal BLU220, BLU230, or BLU240 Wrap Strip with SpecSeal LCI Sealant or SpecSeal Series SSS Sealant, optional steel sleeve.
  3. Insulated Pipes:
    - a. 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.
    - b. 2 Hour Construction: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.
    - c. 2 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID cast-in devices.
    - d. 2 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID cast-in devices.

## **2.07 FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS**

- A. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors:
  1. 1 Hour Construction: UL System F-C-1053; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
  2. 1 Hour Construction: UL System F-C-1162; Specified Technologies Inc. Closet Flange Firestop Gasket.
- B. Non-Metallic Pipe, Conduit or Tubing in Framed Floors:
  1. 1 Hour Construction: UL System F-C-2014; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

2. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
  3. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC collars.
  4. 1 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.
- C. Electrical Cable in Framed Floors:
1. 1 Hour Construction: UL System F-C-3010; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
- D. Insulated Pipe in Framed Floors:
1. 1 Hour Construction: UL System F-C-5043; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

## **2.08 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS**

- A. Penetrations By:
1. Penetrations by Structural Struts, Cables or Threaded Rod:
    - a. 1 and 2 Hour Wall Construction: UL System W-L-7136; F Rating: 1 and 2 Hour; T Rating: 0 Hour; SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant, or SpecSeal LE600 Sealant.
  2. Multiple Penetrations in Large Openings:
    - a. 1, 2, 3, and 4 Hour Wall Construction with EZ Path: UL System W-L-3377; F Rating: 1, 2, 3, and 4 Hour; T Rating: 0, 1/2, 3/4, 1, 1-1/2, and 2 Hour; Firestop Device: EZ PATH Series 22, 33 or 44+ Fire Rated Pathway, optional steel sleeve.
    - b. 1 and 2 Hour Wall Construction: UL System W-L-1168; F Rating: 1 and 2 Hour; T Rating: 1/4, 3/4 and 1 Hour; SpecSeal LC150 Sealant, SpecSeal Series SSS Sealant or SpecSeal LCI Sealant.
    - c. 1 and 2 Hour Wall Construction: UL System W-L-3214; F Rating: 1 and 2 Hour; T Rating: 1/4, 3/4 and 1 Hour; SpecSeal LC150 Sealant, SpecSeal Series SSS Sealant or SpecSeal LCI Sealant.
    - d. 1 and 2 Hour Wall Construction: UL System W-L-8026; F Rating: 1 and 2 Hour; T Rating: 0, 1/2, 1, 1-3/4 and 2 Hour; mineral wool packing with SpecSeal Series SSS Sealant or SpecSeal LCI Sealant.
    - e. 1 and 2 Hour Wall Construction: UL System W-L-8027; F Rating: 1 and 2 Hour; T Rating: 1/4 Hour; SpecSeal LCI Sealant.
  3. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System W-L-1033; Specified Technologies Inc. SIL silicone sealant.
    - b. 2 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
    - c. 2 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.

- d. 2 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
  - e. 1 and 2 Hour Wall Construction: UL System W-L-1049; F Rating: 1 and 2 Hour; T Rating: 0 Hour; SpecSeal 100, 101, 102, 105, 120 or 129 Sealant, SpecSeal LCI Sealant.
  - f. 1 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
  - g. 1 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
  - h. 1 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
4. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
- a. 2 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
  - b. 1 and 2 Hour Wall Construction with pipe clamp ring: UL System W-L-2029; F Rating: 1 and 2 Hour; T Rating: 1, 1-1/2 and 2 Hour; SpecSeal Firestop Collar, SpecSeal LCC Collar.
  - c. 1 and 2 Hour Wall Construction: UL System W-L-2100; F Rating: 1 and 2 Hour; T Rating: 0, 1/4, 1 and 1-1/2 Hour; SpecSeal Series SSS Sealant or SpecSeal LCI Sealant.
  - d. 1 and 2 Hour Wall Construction: UL System W-L-2548; F Rating: 1 and 2 Hour; T Rating: 0 Hour; SpecSeal LCI Sealant or SpecSeal Series SSS Sealant.
  - e. 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
5. Electrical Cables Not In Conduit:
- a. 2 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
  - b. 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
  - c. 2 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
  - d. 2 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
  - e. 1 and 2 Hour Wall Construction: UL System W-L-3210; F Rating: 1 and 2 Hour; T Rating: 3/4 Hour; mineral wool packing with SpecSeal Series SSS Sealant, SpecSeal LCI Sealant or SpecSeal Putty.
  - f. 1 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
  - g. 1 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
6. Cable Trays with Electrical Cables:

- a. 2 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop pillows.
  - b. 2 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
  - c. 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - d. 1 and 2 Hour Wall Construction: UL System W-L-4074; F Rating: 1 and 2 Hour; T Rating: 1/4, 1/2, 1 and 1-1/4 Hour; mineral wool packing with SpecSeal LCI Sealant.
  - e. 1 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop pillows.
  - f. 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
  - g. 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7. Insulated Pipes:
- a. 2 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
  - b. 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
  - c. 2 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
  - d. 1 and 2 Hour Wall Construction: UL System W-L-5054; F Rating: 1 and 2 Hour; T Rating: 3/4 and 1 Hour; SpecSeal Series SSS Sealant or SpecSeal LCI Sealant.
  - e. 1 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
  - f. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - g. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
  - h. 1 Hour Construction: UL System W-L-5096; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, or CP 601S Elastomeric Firestop Sealant.
  - i. 1 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
  - j. 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
8. HVAC Ducts, Uninsulated:
- a. 1 and 2 Hour Wall Construction with up to 100 x 100 inch duct: UL System W-L-7025; F Rating: 1 and 2 Hour; T Rating: 1/2 Hour; Polyethylene backer rod or mineral wool packing with SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant or SpecSeal LE 600 Sealant.

- b. 1 and 2 Hour Wall Construction with up to 24 inch round duct: UL System W-L-7026; F Rating: 1 and 2 Hour; T Rating: 0 Hour; Polyethylene backer rod or mineral wool packing with SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant or SpecSeal LE 600 Sealant.
  - c. 1 and 2 Hour Wall Construction with up to 24 x 24 inch duct: UL System W-L-7029; F Rating: 1 and 2 Hour; T Rating: 1/4 Hour; Polyethylene backer rod or mineral wool packing with SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant or SpecSeal LE 600 Sealant.
9. HVAC Ducts, Insulated:
- a. 1 and 2 Hour Wall Construction with up to 20 inch round duct: UL System W-L-7179; F Rating: 1 and 2 Hour; T Rating: 3/4 Hour; SpecSeal Series SSS Sealant, or SpecSeal LCI Sealant.

## **2.09 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
  - a. UL runs ASTM E814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually with a midyear supplement.
    - 1) Through-Penetration Firestop Devices (XHCR).
    - 2) Fire Resistance Ratings (BXUV).
    - 3) Through-Penetration Firestop Systems (XHEZ).
    - 4) Fill, Voids, or Cavity Material (XHHW).
    - 5) Forming Materials (XHKU).
    - 6) (XHBO)

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.
- B. Pre-Installation Inspection: Inspect all fire and smoke barriers for penetrations of any type; mark or otherwise identify all penetrations indicating action required: 1) repair; 2) firestopping; or 3) smokestopping.
  - 1. Conduct inspection prior to covering up or enclosing walls or ceilings.
  - 2. Conduct inspection jointly with authorized representative of authority having jurisdiction.
- C. If the configuration of a particular penetration does not conform to the configuration necessary for the required firestopping assembly:

1. Notify the installer of the penetration for modification of the configuration to suit the assembly.
2. Do not use the firestopping assembly in other configurations except as specifically stated in the test report or as approved by the authority having jurisdiction.

### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.
- D. Priming:
  1. Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods.
  2. Confine primers to areas of bond.
  3. Do not allow spillage and migration onto exposed surfaces.
- E. Masking:
  1. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work.
  2. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.
- F. Verify that system components are clean, dry, and ready for installation.
- G. Verify that field dimensions are as shown on the Drawings and as recommended by the manufacturer.
- H. Prepare penetrations in accordance with the material manufacturer's instructions.

### **3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
  1. Provide all accessory materials.
- B. Firestop Joint Systems:
  1. Install joint fillers to provide support of firestop materials during application and at the position required to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
  2. Install systems by proven techniques that result in firestop materials:
    - a. Directly contacting and fully wetting joint substrates.
    - b. Completely filling recesses provided for each joint configuration,
    - c. Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
  3. Tool non-sag firestop materials immediately after their application and prior to the time skinning or begins. Form smooth, uniform beads of configuration indicated or required.

- a. Produce fire-resistance rating
  - b. To eliminate air pockets
  - c. To ensure contact and adhesion with sides of joint.
- C. Penetration Firestops:
  - 1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
  - 2. Schedule the work to assure that partitions and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
  - 3. Install forming/damming materials and other accessories in accordance with manufacturers written instructions.
  - 4. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
    - a. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
    - b. Install materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 5. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces
- D. Remove combustible forming materials, unless they are a required component of the tested assembly.
- E. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- F. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- G. Install labeling required by code; Section 07 05 53 - Fire and Smoke Assembly Identification.
  - 1. Near fire and smoke barriers, mark each exposed penetration with label identifying it as a fire-stopped or smoke-stopped assembly.

### **3.04 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
  - 1. Inspection agency to examine firestopping and will determine, in general, that firestopping has been installed in compliance with requirements of tested and listed firestop system, and installation process conforms to FM 4991 - Standard for Approval of Firestop Contractors or UL Qualified Firestop Contractor Program.
  - 2. The inspector shall advise the Contractor of any deficiencies noted within one (1) working day.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.
- C. Do not proceed to enclose firestopping with other construction until inspection agency has verified that the firestop installation complies with the requirements.
- D. Submit report of inspection to the AHJ and Architect.



### **3.05 CLEANING**

- A. Hazardous disposal of firestop materials shall be strictly observed as noted on the individual MSDS.
- B. Clean adjacent surfaces of firestopping materials.
  - 1. Clean up excess material adjacent to penetrations promptly; use methods and materials approved by the manufacturers of the penetration seals and of surfaces to be cleaned.

### **3.06 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.
- B. Protect firestopping during and after curing period from contact with contaminating substances.
- C. Protect installed Work from damage from construction operations using substantial barriers as necessary.
- D. Repair damaged materials in accordance with manufacturer's instructions.

**END OF SECTION**

## **SECTION 07 92 00 JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Owner-provided field quality control.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07 25 00 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- C. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- D. Section 23 31 00 - HVAC Ducts and Casings: Duct sealants.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- C. ASTM C834 - Standard Specification for Latex Sealants.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- H. ASTM C1311 - Standard Specification for Solvent Release Sealants.
- I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
- J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- L. SWRI (VAL) - SWR Institute Validated Products Directory.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
  - 5. Substrates for which use of primer is required.
  - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
  - 7. Sample product warranty.
  - 8. Certification by manufacturer indicating that product complies with specification requirements.
  - 9. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- G. Installation Plan: Submit at least four weeks prior to start of installation.
- H. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- I. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- J. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- K. Installation Log: Submit filled out log for each length or instance of sealant installed.
- L. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
- M. Installer's Qualification Statement.

#### **1.05 QUALITY ASSURANCE**

- A. Maintain one copy of each referenced document covering installation requirements on site.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
  - 1. Adhesion Testing: In accordance with ASTM C794.
  - 2. Compatibility Testing: In accordance with ASTM C1087.
  - 3. Allow sufficient time for testing to avoid delaying the work.
  - 4. Deliver to manufacturer sufficient samples for testing.
  - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
  - 6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- E. Installation Plan: Include schedule of sealed joints, including the following.
  - 1. Joint width indicated in Contract Documents.
  - 2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
  - 3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
  - 4. Approximate date of installation, for evaluation of thermal movement influence.
  - 5. Installation Log Form: Include the following data fields, with known information filled out.
    - a. Unique identification of each length or instance of sealant installed.
    - b. Location on project.
    - c. Substrates.
    - d. Sealant used.
    - e. Stated movement capability of sealant.
    - f. Primer to be used, or indicate as "No primer" used.
    - g. Size and actual backing material used.
    - h. Date of installation.
    - i. Name of installer.
    - j. Actual joint width; provide space to indicate maximum and minimum width.
    - k. Actual joint depth to face of backing material at centerline of joint.
    - l. Air temperature.

- F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
  2. Name(s) of sealant manufacturers' field representatives who will be observing
  3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    - a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
    - b. Test date.
    - c. Location on project.
    - d. Sealant used.
    - e. Stated movement capability of sealant.
    - f. Test method used.
    - g. Date of installation of field sample to be tested.
    - h. Date of test.
    - i. Copy of test method documents.
    - j. Age of sealant upon date of testing.
    - k. Test results, modeled after the sample form in the test method document.
    - l. Indicate use of photographic record of test.
- G. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.
- H. Field Quality Control Plan:
1. Visual inspection of entire length of sealant joints.
  2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
    - a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
    - b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.
  3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
    - a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
    - b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- I. Field Adhesion Test Procedures:
    1. Allow sealants to fully cure as recommended by manufacturer before testing.
    2. Have a copy of the test method document available during tests.
    3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
    4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
    5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
    6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
    7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
  - J. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
    1. Record results on Field Quality Control Log.
    2. Repair failed portions of joints.
  - K. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
    1. Sample: At least 18 inches long.
    2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
    3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
    4. Record results on Field Quality Control Log.
    5. Repair failed portions of joints.
  - L. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

## **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

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

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. Adhesives Technology Corporation: [www.atcepoxy.com](http://www.atcepoxy.com).
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 3. Dow Corning Corporation: [www.dowcorning.com/construction/sle](http://www.dowcorning.com/construction/sle).
  - 4. Fortifiber Building Systems Group: [www.fortifiber.com/sle](http://www.fortifiber.com/sle).
  - 5. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 6. Master Builders Solutions by BASF: [www.master-builders-solutions.basf.us/en-us/#sle](http://www.master-builders-solutions.basf.us/en-us/#sle).
  - 7. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com/sle](http://www.momentive.com/sle).
  - 8. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 9. QUIKRETE Companies: [www.quikrete.com/#sle](http://www.quikrete.com/#sle).
  - 10. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - 11. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  - 12. Specified Technologies Inc: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
  - 13. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 14. W.R. Meadows, Inc: [www.wrmeadows.com/sle](http://www.wrmeadows.com/sle).
  - 15. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
  - 1. Adhesives Technology Corporation: [www.atcepoxy.com](http://www.atcepoxy.com).
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 3. Dayton Superior Corporation: [www.daytonsuperior.com](http://www.daytonsuperior.com).
  - 4. Dow Corning Corporation: [www.dowcorning.com/construction/sle](http://www.dowcorning.com/construction/sle).
  - 5. Master Builders Solutions by BASF: [www.master-builders-solutions.basf.us/en-us/#sle](http://www.master-builders-solutions.basf.us/en-us/#sle).
  - 6. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 7. QUIKRETE Companies: [www.quikrete.com/#sle](http://www.quikrete.com/#sle).
  - 8. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - 9. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  - 10. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 11. W.R. Meadows, Inc: [www.wrmeadows.com/sle](http://www.wrmeadows.com/sle).
  - 12. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.02 JOINT SEALANT APPLICATIONS

### A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
  - a. Wall expansion and control joints.
    - 1) Unit Masonry.
    - 2) Cement Plastering System.
    - 3) Metal and Composite Panels.
    - 4) Siding.
  - b. Construction joints in cast-in-place concrete
  - c. Joints between door, window, and other frames and adjacent construction.
  - d. Joints between different exposed materials.
  - e. Openings below ledge angles in masonry.
  - f. Control and expansion joints in ceilings and other overhead surfaces.
  - g. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
  - a. Joints between door, window, and other frames and adjacent construction.
  - b. Control and expansion joints on exposed interior surfaces of exterior walls.
  - c. Perimeter joints of exterior openings where indicated.
  - d. Control and expansion joints in tile.
  - e. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
    - 1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
    - 2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
  - f. Other joints indicated below.
3. Do not seal the following types of joints.
  - a. Intentional weepholes in masonry.
  - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
  - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
  - d. Joints where installation of sealant is specified in another section.
  - e. Joints between suspended panel ceilings/grid and walls.



- B. Type EP-1 - Exterior Joints: Use non-sag non-staining silicone sealant at storefront and openings, unless otherwise indicated.
- C. Type SM-1 - Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
- D. Type SM-1 - Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
- E. Type CP-1 - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- F. Type IP-1 - Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
- G. Type IA-1 - Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
- H. Type WP-1 - Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
- I. Type FS-1 - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
- J. Type IA-1 - In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- K. Type WFP-1 - Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- L. Interior Wet Areas: restrooms and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.
- M. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

### **2.03 JOINT SEALANTS - GENERAL**

- A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 61 16.
- B. Colors: As indicated on the drawings. Match adjacent surface.

### **2.04 NONSAG JOINT SEALANTS**

- A. Type NS-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 50 percent, minimum.
  - 2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's full range.
  - 4. Cure Type: Single-component, neutral moisture curing.
  - 5. Service Temperature Range: Minus 20 to 180 degrees F.
  - 6. Manufacturers:
    - a. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - b. Dow Chemical Company; DOWSIL 791 Silicone Weatherproofing Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - c. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).

- d. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com/sle](http://www.momentive.com/sle).
  - e. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - f. Sika Corporation; Sikasil WS-290: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - g. Sika Corporation; Sikasil WS-295: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - h. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
- 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Color: To be selected by Architect from manufacturer's full range.
  - 3. Cure Type: Single-component, neutral moisture curing
  - 4. Service Temperature Range: Minus 65 to 180 degrees F.
  - 5. Manufacturers:
    - a. Fortifiber Building Systems Group; Moistop Sealant: [www.fortifiber.com/#sle](http://www.fortifiber.com/#sle).
    - b. Dow Chemical Company; DOWSIL 999-A Building and Glazing Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - c. Pecora Corporation; Pecora 890FTS (Field Tintable Smooth): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - d. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com/sle](http://www.momentive.com/sle).
    - e. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - f. Sika Corporation; Sikasil GP: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - g. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Type FS-1 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
- 1. Color: White.
  - 2. Manufacturers:
    - a. BASF Construction Chemicals-Building Systems; OmniPlus, by Sonneborn Building Products Div.: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
    - b. Dow Corning Corporation; 786 Silicone Sealant: [www.dowcorning.com](http://www.dowcorning.com).
    - c. Momentive Performance Materials, Inc (GE Silicones products); Silpruf SCS 1700 Sanitary: [www.momentive.com](http://www.momentive.com).
    - d. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - e. Sika Corporation; Sikasil GP: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.

- D. Type ST-1 - Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's full range.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Manufacturers:
    - a. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Type PS-1 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 2. Color: To be selected by Architect from manufacturer's full range.
  - 3. Service Temperature Range: Minus 40 to 180 degrees F.
  - 4. Manufacturers:
    - a. Master Builders Solutions by BASF; MasterSeal NP1: [www.master-builders-solutions.basf.us/en-us/#sle](http://www.master-builders-solutions.basf.us/en-us/#sle).
    - b. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - c. Sika Corporation; Sikaflex-1a: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - d. Sika Corporation; Sikaflex-15 LM: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - e. W. R. Meadows, Inc; POURTHANE NS: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Type WP-1 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
  - 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's full range.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Manufacturers:
    - a. Sika Corporation; Sikaflex-1a: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's full range.
  4. Service Temperature Range: Minus 40 to 180 degrees F.
- H. Type IA-1 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's full range.
  2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
  3. Manufacturers:
    - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - b. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - c. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
    - d. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - e. Specified Technologies Inc; Smoke N' Sound Acoustical Sealant: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

## 2.05 SELF-LEVELING SEALANTS

- A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
  2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's full range.
  4. Service Temperature Range: Minus 40 to 180 degrees F.
  5. Manufacturers:
    - a. Sika Corporation; Sikasil 728SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
  6. Movement Capability: Plus and minus 25 percent, minimum.
  7. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  8. Color: To be selected by Architect from manufacturer's full range.
  9. Service Temperature Range: Minus 40 to 180 degrees F.
  10. Manufacturers:
    - a. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
    - b. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).

- c. Sika Corporation; Sikaflex-1c SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Type WFP-1 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's full range.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Manufacturers:
    - a. Sika Corporation; Sikaflex-1c SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - b. W. R. MEADOWS, Inc; POURTHANE SL: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Self-Leveling Polysulfide Sealant: ASTM C920, Grade P, Uses M and A; multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
  - 1. Movement Capability: Plus and minus 25 percent.
  - 2. Hardness Range: 30 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's full range.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Manufacturers:
    - a. W.R. Meadows, Inc; Deck-O-Seal (pourable): [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
  - 1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.
  - 2. Manufacturers:
    - a. ARDEX Engineered Cements; ARDEX ARDIFIX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
  - 1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
  - 2. Color: To be selected by Architect from manufacturer's standard colors.
  - 3. Joint Width, Minimum: 1/8 inch.
  - 4. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.

5. Manufacturers:
  - a. Adhesives Technology Corporation; \_\_\_\_\_: [www.atcepoxy.com/#sle](http://www.atcepoxy.com/#sle).
  - b. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - c. Euclid Chemical Company; EUCO QWIKjoint UVR: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
  - d. Nox-Crete Inc; DynaFlex JF-85: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
  - e. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.06 ACCESSORIES**

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
  2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
  1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
  2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
  3. Arrange for sealant manufacturer's technical representative to be present during tests.
  4. Record each test on Preinstallation Adhesion Test Log as indicated.
  5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.

6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
  1. Width/depth ratio of 2:1.
  2. Neck dimension no greater than 1/3 of the joint width.
  3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

### **3.04 FIELD QUALITY CONTROL**

- A. Owner will employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.
- D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

- E. Repair destructive test location damage immediately after evaluation and recording of results.

### **3.05 POST-OCCUPANCY**

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

**END OF SECTION**



**SECTION 08 06 71**  
**DOOR HARDWARE SCHEDULE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preliminary schedule of door hardware sets for swinging as indicated on drawings.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 71 00 - Door Hardware: Requirements to comply with in coordination with this section.

**1.03 REFERENCE STANDARDS**

- A. BHMA (CPD) - Certified Products Directory.
- B. BHMA A156.3 - Exit Devices.
- C. BHMA A156.5 - Cylinders and Input Devices for Locks.
- D. BHMA A156.13 - Mortise Locks & Latches Series 1000.
- E. BHMA A156.18 - Materials and Finishes.
- F. DHI (H&S) - Sequence and Format for the Hardware Schedule.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Comply with submittal requirements as indicated in Section 08 71 00.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Only manufacturers listed in Door Hardware Schedule or Section 08 71 00 are considered acceptable, unless noted otherwise.
- B. Obtain each type of door hardware as indicated from a single manufacturer and single supplier.
- C. Products are listed and certified compliant with specified standards by BHMA (CPD).
- D. Manufacturer's Abbreviations: Coordinate with manufacturers listed in Section 08 71 00.
  - 1. AR/AD - Adams Rite, Assa Abloy Door Security Solutions.
  - 2. BM - Besam, Assa Abloy Door Security Solutions.
  - 3. CR/RU - Corbin Russwin, Assa Abloy Door Security Solutions.
  - 4. CUR - Curries, Assa Abloy Door Security Solutions.
  - 5. HES/HS - HES, Assa Abloy Door Security Solutions.
  - 6. HD - HID Global, Assa Abloy Door Security Solutions.
  - 7. KNX/KNO - Knox Company.

8. McK/MK - McKinney, Assa Abloy Door Security Solutions.
9. NOR/NO - Norton.
10. PEM/PE - Pemko, Assa Abloy Door Security Solutions.
11. RIX/RF - Rixson Specialty Door Controls, Assa Abloy Door Security Solutions.
12. ROC/RO - Rockwood.
13. SA - Sargent, Assa Abloy Door Security Solutions.
14. SEC/SU - Securitron, Assa Abloy Door Security Solutions.
15. YA - Yale, Assa Abloy Door Security Solutions.
16. TBD - To be determined.
17. BYO/OT - By Others.

## **2.02 DESCRIPTION**

- A. Door hardware sets provided represent the design intent, they are only a guideline and should not be considered a detailed or complete hardware schedule.
  1. Provide door hardware item(s) as required for similar purposes, even when item is not listed for a door in Door Hardware Schedule.
  2. Necessary items that are not included in a Hardware Set should be added and have the appropriate additional hardware as required for proper application and functionality.
  3. Door hardware supplier is responsible for providing proper size and hand of door for products required in accordance with Door Hardware Schedule and as indicated on drawings.
  4. Quantities listed are for each Pair (PR) of doors, or for each Single (SGL) door, as indicated in hardware sets.

## **2.03 LOCK FUNCTION CODES**

- A. Function Codes for Cylindrical Locks: Complying with BHMA A156.5.
- B. Function Codes for Mortise Locks: Complying with BHMA A156.13.
- C. Function Codes for Exit Devices: Complying with BHMA A156.3.

## **2.04 FINISHES**

- A. Finishes: Complying with BHMA A156.18.

# **PART 3 EXECUTION**

## **3.01 DOOR HARDWARE SCHEDULE**

- A. Organize listing of door hardware components within each hardware set in compliance with 10-Part scheduling sequence indicated in DHI (H&S), unless otherwise indicated.
- B. See door schedule in drawings for hardware set assignments.
- C. No hardware shall be ordered until Finished Hardware has been reviewed and approved by Architect's hardware consultant.

- D. Provide Factory order numbers for all products supplied on this project as part of close out documents for Owner's warranty records.
- E. Any door count quantity shown in the HW set listings is for reference only. Contractor shall verify all door quantities with the Architectural Drawings.
- F. Hardware Sets:
- G. SCHEDULED DOOR HARDWARE
  - 1. Refer to "PART 3 – EXECUTION" for required specification sections.

- 1. MK - McKinney
- 2. PE - Pemko
- 3. YA - ASSA ABLOY ACCENTRA
- 4. RO - Rockwood
- 5. RF - Rixson
- 6. NO - Norton
- 7. OT - Other

### **Hardware Sets**

#### **Set: 1.0**

Doors: 126A, 133A, 138B

1	Continuous Hinge	<a href="#">CFMHD1</a>		PE
1	Rim Exit Device, Nightlatch	<a href="#">6100ED 121NL 5CH Temp Core-6 pin</a>	630	YA
1	Core	<a href="#">1210</a>	626	YA
1	Door Pull	<a href="#">RM3311-12 HF Posts</a>	US32D	RO
1	Surface Closer	<a href="#">CPS7500</a>	689	NO
1	Rain Guard	<a href="#">346C (Omit @ Overhang)</a>		PE
1	Weatherstripping	Gasketing by Door/Frame Manufacturer		OT
1	Sweep	<a href="#">315CN</a>		PE
1	Threshold	<a href="#">Per Sill Detail</a>		PE

**Set: 2.0**

Doors: 100A

1	Continuous Hinge	<a href="#">CFMHD1</a>		PE
1	Mullion	<a href="#">KRM200SM</a>	600	YA
1	Rim Exit Device, Nightlatch	<a href="#">6100ED 121NL 5CH Temp Core-6 pin</a>	630	YA
2	Core	<a href="#">1210</a>	626	YA
1	Housing, Mortise	<a href="#">2221</a>	626	YA
1	Door Pull	<a href="#">RM3311-12 HF Posts</a>	US32D	RO
1	Surface Closer	<a href="#">CPS7500</a>	689	NO
1	Rain Guard	<a href="#">346C (Omit @ Overhang)</a>		PE
1	Weatherstripping	Gasketing by Door/Frame Manufacturer		OT
1	Sweep	<a href="#">315CN</a>		PE
1	Threshold	<a href="#">Per Sill Detail</a>		PE

**Set: 3.0**

Doors: 100B

1	Continuous Hinge	<a href="#">CFMHD1</a>		PE
1	Rim Exit Device, Nightlatch	<a href="#">6100ED 121NL 5CH Temp Core-6 pin</a>	630	YA
1	Core	<a href="#">1210</a>	626	YA
1	Door Pull	<a href="#">RM3311-12 HF Posts</a>	US32D	RO
1	Surface Closer	<a href="#">CPS7500</a>	689	NO

**Set: 4.0**Doors: [131A](#), [205A](#), [205B](#)

3	Hinge, Full Mortise, Hvy Wt	<a href="#">T4A3386 NRP</a>	US32D	MK
1	Rim Exit Device, Nightlatch	<a href="#">6100ED 121NL 5CH Temp Core-6 pin</a>	630	YA
1	Core	<a href="#">1210</a>	626	YA
1	Door Pull	<a href="#">RM3311-12 HF Posts</a>	US32D	RO
1	Surface Closer	<a href="#">CPS7500</a>	689	NO
1	Rain Guard	<a href="#">346C (Omit @ Overhang)</a>		PE
1	Weatherstripping	Gasketing by Door/Frame Manufacturer		OT
1	Gasketing	<a href="#">303AS @ H &amp; J</a>		PE
1	Sweep	<a href="#">315CN</a>		PE
1	Threshold	<a href="#">Per Sill Detail</a>		PE

**Set: 5.0**Doors: [132A](#), [141A](#)

4

Hinge, Full  
 Mortise, Hvy [T4A3386](#) US32D MK  
 Wt [NRP](#)

1	Rim Exit Device, Nightlatch	<a href="#">6100ED 121NL 5CH Temp Core-6 pin</a>	630	YA
1	Core	<a href="#">1210</a>	626	YA
1	Door Pull	<a href="#">RM3311-12 HF Posts</a>	US32D	RO
1	Surface Closer	<a href="#">CPS7500</a>	689	NO
1	Rain Guard	<a href="#">346C (Omit @ Overhang)</a>		PE
1	Weatherstripping	Gasketing by Door/Frame Manufacturer		OT
1	Gasketing	<a href="#">303AS @ H &amp; J</a>		PE
1	Sweep	<a href="#">315CN</a>		PE
1	Threshold	<a href="#">Per Sill Detail</a>		PE

**Set: 6.0**Doors: [139A](#)

4	Hinge, Full Mortise, Hvy Wt	<a href="#">T4A3386 NRP</a>	US32D	MK
1	Storeroom or Closet Lock	<a href="#">AU 4705LN 1210 Temp Core-6 pin</a>	626	YA
1	Core	<a href="#">1210</a>	626	YA
1	Surf Overhead Stop	<a href="#">55-x36</a>	689	RF
1	Rain Guard	<a href="#">346C (Omit @ Overhang)</a>		PE
1	Gasketing	<a href="#">303AS @ H &amp; J</a>		PE
1	Sweep	<a href="#">315CN</a>		PE
1	Threshold	<a href="#">Per Sill Detail</a>		PE

**Set: 7.0**Doors: [138D](#)

8 Hinge, Full Mortise, Hvy Wt	<a href="#">T4A3386 NRP</a>	US32D MK
1 Mullion	<a href="#">KRM200SM</a>	600 YA
2 Rim Exit Device, Classroom/Storeroom	<a href="#">6100ED AU426F 5CH 1210 Temp Core-6 pin</a>	630 YA
3 Core	<a href="#">1210</a>	626 YA
1 Housing, Mortise	<a href="#">2221</a>	626 YA
2 Surface Closer	<a href="#">7500</a>	689 NO
2 Wall Stop	<a href="#">403</a>	US26D RO
1 Gasketing	<a href="#">5110BL</a>	PE
2 Silencer	<a href="#">608-RKW</a>	RO

**Set: 8.0**Doors: [138A](#), [143A](#)

3 Hinge, Full Mortise, Hvy Wt	<a href="#">T4A3386 NRP</a>	US32D MK
1 Rim Exit Device, Classroom/Storeroom	<a href="#">6100ED AU426F 5CH 1210 Temp Core-6 pin</a>	630 YA
1 Core	<a href="#">1210</a>	626 YA
1 Surface Closer	<a href="#">7500</a>	689 NO
1 Wall Stop	<a href="#">403</a>	US26D RO
3 Silencer	<a href="#">608-RKW</a>	RO

**Set: 9.0**

Doors: 100C, 136A, 136B, 137A, 138E

3 Hinge, Full Mortise, Hvy Wt	<a href="#">T4A3386 NRP</a>	US32D MK
1 Rim Exit Device, Classroom/Storeroom	<a href="#">6100ED AU426F 5CH 1210 Temp Core-6 pin</a>	630 YA
1 Core	<a href="#">1210</a>	626 YA
1 Surface Closer	<a href="#">7500</a>	689 NO
1 Wall Stop	<a href="#">403</a>	US26D RO
1 Gasketing	By Aluminum Frame Manufacturer	OT

**Set: 10.0**Doors: [124A](#), [145A](#), [202A](#), [204A](#)

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Storeroom or Closet Lock	<a href="#">AU 4705LN 1210 Temp Core-6 pin</a>	626 YA
1 Core	<a href="#">1210</a>	626 YA
1 Surface Closer	<a href="#">7500</a>	689 NO
1 Kick Plate	<a href="#">K1050 10" high CSK BEV</a>	US32D RO
1 Wall Stop	<a href="#">403</a>	US26D RO
3 Silencer	<a href="#">608-RKW</a>	RO

**Set: 11.0**Doors: [144A](#)

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Storeroom or Closet Lock	<a href="#">AU 4705LN 1210 Temp Core-6 pin</a>	626 YA
1 Core	<a href="#">1210</a>	626 YA
1 Surface Closer	<a href="#">7500</a>	689 NO
1 Kick Plate	<a href="#">K1050 10" high CSK BEV</a>	US32D RO
1 Mop Plate	<a href="#">K1050 6" high CSK BEV</a>	US32D RO
1 Wall Stop	<a href="#">403</a>	US26D RO
3 Silencer	<a href="#">608-RKW</a>	RO

**Set: 12.0**Doors: [109A](#), [110A](#), [118A](#), [119A](#), [129A](#), [130A](#), [201A](#)

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Entry Lock	<a href="#">AU 4707LN Temp Core-6 pin</a>	626 YA
1 Core	<a href="#">1210</a>	626 YA
1 Wall Stop	<a href="#">403</a>	US26D RO
3 Silencer	<a href="#">608-RKW</a>	RO

**Set: 13.0**

Doors: 101A, 102A, 103A, 104A, 105A, 106A, 107A, 108A, 114A, 115A, 116A, 122A, 125A

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Entry Lock	<a href="#">AU 4707LN Temp Core-6 pin</a>	626 YA
1 Core	<a href="#">1210</a>	626 YA
1 Wall Stop	<a href="#">403</a>	US26D RO
1 Gasketing	By Aluminum Frame Manufacturer	OT

**Set: 14.0**

Doors: 127A, 128A

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Entry Lock	<a href="#">AU 4707LN Temp Core-6 pin</a>	626 YA
1 Core	<a href="#">1210</a>	626 YA
1 Conc Overhead Stop	<a href="#">2-x36</a>	689 RF
1 Gasketing	By Aluminum Frame Manufacturer	OT

**Set: 15.0**Doors: [121A](#), [134A](#), [135A](#), [203A](#)

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Privacy Lock	<a href="#">AUR 8802FL V21</a>	626 YA
1 Surface Closer	<a href="#">7500 DA</a>	689 NO
1 Kick Plate	<a href="#">K1050 10" high CSK BEV</a>	US32D RO
1 Mop Plate	<a href="#">K1050 6" high CSK BEV</a>	US32D RO
1 Wall Stop	<a href="#">403</a>	US26D RO
1 Gasketing	<a href="#">S88BL</a>	PE



**Set: 16.0**

Doors: 131C

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Classroom Lock	<a href="#">AU 4708LN 1210 Temp Core-6 pin</a>	626 YA
1 Core	<a href="#">1210</a>	626 YA
1 Surface Closer	<a href="#">7500</a>	689 NO
1 Kick Plate	<a href="#">K1050 10" high CSK BEV</a>	US32D RO
1 Wall Stop	<a href="#">403</a>	US26D RO
3 Silencer	<a href="#">608-RKW</a>	RO

**Set: 17.0**Doors: [112A](#), [113A](#)

3 Hinge, Full Mortise	<a href="#">TA2714 NRP</a>	US26D MK
1 Push Pull	<a href="#">110x73C/73CL</a>	US32D RO
1 Kick Plate	<a href="#">K1050 10" high CSK BEV</a>	US32D RO
1 Mop Plate	<a href="#">K1050 6" high CSK BEV</a>	US32D RO
1 Wall Stop	<a href="#">403</a>	US26D RO
1 Gasketing	<a href="#">S88BL</a>	PE

**Set: 18.0**

Doors: 131B, 138C, 205C

1 Hardware	By Door Supplier	OT
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**Set: 19.0**

Doors: 123A

1 Hardware	Reuse Existing	OT
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**END OF SECTION**

## **SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Fire-rated hollow metal doors and frames.
- C. Thermally insulated hollow metal doors with frames.
- D. Hollow metal borrowed lites glazing frames.
- E. Accessories, including glazing and louvers.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

#### **1.03 ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NAAMM: National Association of Architectural Metal Manufacturers.
- D. NFPA: National Fire Protection Association.
- E. SDI: Steel Door Institute.
- F. UL: Underwriters Laboratories.

#### **1.04 REFERENCE STANDARDS**

- A. 12-7-4 CA Ref Stds - California Referenced Standards Code Chapter 12-7-4 Fire Resistive Standards.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
- D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- E. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- F. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- G. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

- H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- L. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- M. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
- N. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- O. ITS (DIR) - Directory of Listed Products.
- P. NAAMM HMMA 820 TN03 - Guidelines for Glazing of Hollow Metal Transoms, Sidelights and Windows.
- Q. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.
- R. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
- S. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames.
- T. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
- U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- V. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- W. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- X. SDI 113 - Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies.
- Y. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- Z. UL (DIR) - Online Certifications Directory.
- AA. UL 10B - Standard for Fire Tests of Door Assemblies.
- BB. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
  - 1. Show fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
  - 2. Provide schedule of doors and frames using same reference numbers for details and openings as those indicated on Drawings.
  - 3. Indicate coordination of glazing frames and stops with glass and glazing requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Provide packaging such as cardboard, or other containers to protect surfaces of hollow metal doors. Strap welded frames together in pairs with head of one unit inverted or provide temporary spreaders fastened to the bottom of each frame.
- B. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  - 1. Store doors and frames on platforms under cover.
  - 2. Store doors and frames in dry storage spaces, with adequate ventilation, free from dust, and which permits easy access for inspection and handling.
  - 3. Avoid using nonvented plastic or canvas shelters that create a humidity chamber.
  - 4. If the wrapper on the door becomes wet, remove the wrapper.
- C. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Fire-Rated Door Assemblies: Meet the requirements of the California Building Code (CBC), Title 24, Part 2, Chapter 7 - Fire Resistance Rated Construction for the fire resistive ratings indicated, and which are labeled by Underwriter's Laboratories, Factory Mutual, or other testing agency acceptable to the State Fire Marshal.
  - 1. Fire-rated door and frame construction: Conform to NFPA 252, applicable CBC Standard [12-7-4 CA Ref Stds](#) and requirements of Factory Mutual System (FM). Labels on fire-rated doors and frames shall identify FM listing approval. Comply with UL 10B.
  - 2. Fire-rated door and frame installation: NFPA 80 - Fire Door Installation and applicable CBC Standards for fire rated class indicated.
  - 3. Fire-rated doors, intumescent seals: UL 10C compliant. If intumescent seals are required for the fire labeled assembly, furnish flush with door edge type seals or kerfed in frame type seals. Surface applied adhesive seals will not be accepted. Coordinate frame fabrication to allow use of kerfed in frame type seal options.
  - 4. Temperature rise rating: At exit stairwell enclosures, exit passageways, and horizontal exits, provide doors which are labeled for a maximum transmitted temperature end point not to exceed 450 degrees above ambient at the end of 30 minutes of fire exposure.
  - 5. Oversize fire-rated door assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to the State Fire Marshal that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  - 6. Where fire resistive doors are indicated to be equipped with louvers, provide fusible link type louvers acceptable to the testing agency labeling the fire door and frame assembly.
    - a. Exception: Louvers are not to be used in "S" rated door assemblies. CBC Section 710.5.2.1 and 716.2.2.1.1.
  - 7. All exit/access doorways and other doors opening into a fire rated corridor shall be protected by tight-fitting smoke and draft control assemblies having a fire rating of not less than 20 minutes when tested in accordance with CBC Standards and shall be labeled accordingly per CBC section 716.2.2.1.

### **2.02 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  - 1. Ceco Door, an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Curries, an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 3. Door Components Inc.; [www.doorcomponents.com](http://www.doorcomponents.com).
  - 4. Steelcraft, an Allegion brand: [www.allegion.com/sle](http://www.allegion.com/sle).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.03 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  2. Accessibility: Comply with ADAAG 2010 and CBC Chapter 11B.
  3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
    - a. Watertight at exterior gates.
  4. Door Edge Profile: Beveled, both sides.
  5. Typical Door Face Sheets: Flush. Smooth .
  6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
  7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

## **2.04 HOLLOW METAL DOORS**

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
  1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
    - b. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
  2. Core Material: Vertical steel stiffeners with fiberglass batts.
    - a. Exception: Insulation not required for exterior gates.
  3. Door Thermal Resistance: R-Value of \_\_\_\_\_.
    - a. Doors with no glazing or less than 50 percent glazed shall comply with the required U-factor not greater than the applicable value (0.70) in Subchapter Table 140.3-B, C, or D. California Energy Code Section 140.3 (a) 7.
  4. Door Thickness: 1-3/4 inches, nominal.
  5. Weatherstripping: Refer to Section 08 71 00.

- a. Maximum Air Leakage, ASTM E283: 0.30cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity). California Energy Code Section 110.6(a) 1.
- C. Interior Doors, Non-Fire-Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 2 - Seamless.
    - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
    - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
  - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
  - 3. Door Thickness: 1-3/4 inches, nominal.
- D. Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 2 - Seamless.
    - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
  - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
    - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    - b. Attach fire rating label to each fire rated unit.
  - 3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
    - a. Fabricate to the requirements of NFPA 252 for the hourly rates indicated.
  - 4. Door Thickness: 1-3/4 inches, nominal.

## **2.05 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
  - 1. Provide compatible primer for Section 09 96 00 - High-Performance Coatings.
- C. Exterior Door Frames: Thermally broken, face welded type.
  - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
  - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
    - a. Frame Reinforcements:
      - 1) Hinges: 7 gauge 0.1793 inch

- 2) Closer: 12 gauge 0.093 inch.
- 3. Thermal Performance Testing: SDI 113 or ASTM C1363.
- 4. Weatherstripping: Separate, see Section 08 71 00.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
  - 1. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
- E. Door Frames, Fire-Rated: Full profile/continuously welded type.
  - 1. Fire Rating: Same as door, labeled.
  - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- F. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
- G. Frames for Interior Glazing, Borrowed Lights, Sidelights, and Exterior Windows: Construction and face dimensions to match door frames, and as indicated on drawings.
  - 1. Full formed, concealed fastenings, welded corners, fabricated as for door frames.
  - 2. Shapes as detailed and scheduled on Drawings.
  - 3. Provide single rabbet frames at all Interior Glazing, Borrowed Lights, Sidelights, and Exterior Windows.
  - 4. Cold rolled steel with anchors same as for door frames for respective wall condition.
    - a. Exception:
      - 1) Jamb anchors located within 6 inches of head and sill plus spaced not more than 24 inches on center.
      - 2) Head and sill anchors located within 6 inches of jambs plus spaced not more than 24 inches on center.
- H. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

## 2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
  - 1. Exterior Steel Doors and Door Frames: Comply with requirements for primer for finish coats.
  - 2. Interior Steel Doors and Rolled Steel Door Frames: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- D. Field Applied Finish Painting: As specified in:
  - 1. Section 09 91 13 - Exterior Painting.
  - 2. Section 09 91 23 - Interior Painting.
  - 3. Exterior Doors (Abuse Resistant): Section 09 96 00 - High-Performance Coatings.



## 2.07 ACCESSORIES

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
  - 1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
  - 2. Style: Sightproof inverted Y blade.
    - a. Fixed: Where indicated, provide fixed louvers consisting of inverted blades, formed of not lighter than 18 gage steel, welded or tenoned to 18 gage steel frames. Form louvers of same material specified for stiles and rails.
  - 3. Size: 20 x 12 inch
  - 4. Moldings:
    - a. Not lighter than 18 gage galvanized steel moldings, or 18 gage hot or cold rolled steel moldings.
    - b. Moldings shall be nonremovable on exterior or corridor side of door.
    - c. Form moldings for exterior doors of hot dip galvanized steel.
  - 5. Fasteners: Exposed, tamper proof fasteners.
  - 6. Insect Screens: Provide with 18 by 14 mesh bronze insect screen fabric in a zinc coated steel, rewireable frame finished to match the door.
- B. Glazing: As specified in Section 08 80 00, factory installed.
  - 1. Glazed Openings: Comply with CBC Section 716.3.2.1.2 and Chapter 24.
    - a. Vision Panel: Factory installed.
      - 1) Application: Provide at all new classroom, office, corridor and other teacher and staff occupied spaces.
      - 2) Size (WxH): 6 by 37 inches, unless indicated otherwise on Drawings.
- C. Door Wire Mesh Frames: Frames with wire mesh securely fastened within door opening.
  - 1. Size: As indicated on drawings, based on door panel. Full lites top and bottom.
    - a. Top Rail: 8 inches.
    - b. Stiles: 8 inches.
    - c. Middle Rail: 10 inches.
    - d. Bottom Rail: 10 inches.
  - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
  - 3. Metal Finish: Gray polyester powder coating. Paint to match door.
  - 4. Woven Wire Mesh: Heavy duty.
    - a. Material: Carbon Steel, Cold Rolled, Woven, I3I3 Crimp Style.
    - b. Wire Size: 10 gauge, 0.135 inch.
    - c. Mesh Opening Size: 1 inch square shape.
    - d. Mesh Weave: Plain weave, inter-crimped.
    - e. Basis of Design: ITEM 3692900041 - 48" x 120" as manufactured by McNichols, [www.mcnichols.com](http://www.mcnichols.com), or equal.

- D. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
  - 1. Glazing Stops: Channel glazing stops, completely fit ready for removal and glazing at site.
  - 2. Place on exterior side with tamper proof screws.
- E. Astragals for Double Doors: Specified in Section 08 71 00.
- F. Supports and Anchors: Fabricate of not less than 16 gage sheet steel; galvanized where used with galvanized frames or at exterior, damp or wet locations.
  - 1. Anchors: Provide in accordance with ANSI/SDI A250.11.
    - a. Anchors at fire rated frames shall also conform to UL 10B.
    - b. Provide one floor anchor and the number of wall anchors listed below welded into each jamb member.
      - 1) Number of anchors at:
        - (a) Concrete or Masonry: Typically 3, and 4 for doors over 7'-0" high.
        - (b) Steel Stud Partitions: Typically 4, and 5 for doors over 7'-0" high.
    - c. Wall anchors shall be of type indicated for the specific wall condition and of same material specified for frames.
    - d. Provide head anchors welded into head member as recommended by the frame manufacturer.
    - e. All anchors shall be 16 gage minimum for galvanized frames and 16 gage minimum for cold or hot rolled steel frames.
    - f. Provide "Z" spacer type anchors for all wood studs.
  - 2. Punch and dimple jambs within 6 inches of bottom for attachment to concrete stem walls where occur.
- G. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
  - 1. Omit silencers where head and jamb bulb-type weatherstripping or sound seals are to be installed and omit where in violation of fire rating. Silencers are specified in Section 08 71 00 - Door Hardware.
- H. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- I. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A153/A153M, Class C or D as applicable.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.03 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. In addition, install fire rated units in accordance with NFPA 80 and their listing.
  - 1. Provide clearances as specified in NFPA 80, NFPA 105, and as required by California Building Code (CBC).
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 71 00.
  - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- E. Coordinate installation of electrical connections to electrical hardware items.
- F. Doors Installation, General: Hang doors and adjust for proper clearances and operation. Refer to Section 08 71 00 - Door Hardware for hardware requirements.
- G. For waterproofing of hollow metal window frames, follow NAAMM HMMA 820 TN03.
- H. Touch up damaged factory finishes.

### **3.04 REPAIRS:**

- A. Make repairs only if permitted by Architect. Otherwise, replace damaged components.
- B. Fill surface depressions with metallic paste filler, allow to thoroughly cure, sand flush, and smooth for an invisible appearance with adjacent metal surfaces.
- C. Sand smooth all rusted areas.
- D. Repair galvanized surfaces with specified repair compound.
- E. Apply touch-up paint using air drying primer compatible with shop-applied finish.

### **3.05 TOLERANCES**

- A. Flush Steel Door Installation Tolerances: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI A250.8.
- B. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- C. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### **3.06 ADJUSTING**

- A. Adjust for smooth and balanced door movement.
- B. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

### **3.07 CLEANING AND PROTECTION**

- A. Prime Coat Touch-up: Immediately after installation, sand smooth all corroded (rusted), damaged and deteriorated areas of prime coat and apply touch-up coat of compatible air-drying primer.
- B. Protection: Protect installed frames and doors from damage.
  - 1. Provide protective coverings and other devices as necessary, in conformance to requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
  - 2. Remove protective devices from prefinished components for Substantial Completion review.
- C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.
- D. Cleaning: Clean doors and frames of surface contaminants detrimental to proper application of field-applied finishes.

### **3.08 SCHEDULE - SEE DRAWINGS**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**

**SECTION 08 31 00**  
**ACCESS DOORS AND PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall- and ceiling-mounted access units.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting: Field paint finish.

**1.03 REFERENCE STANDARDS**

- A. ITS (DIR) - Directory of Listed Products.
- B. UL (FRD) - Fire Resistance Directory.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Installer's qualification statement.
- F. Project Record Documents: Record actual locations of each access unit.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- C. Single-Source Responsibility: Obtain access doors for entire project from one source from a single manufacturer.
- D. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.
- E. Coordination: Furnish inserts and anchoring devices for building into adjoining Work for installation of access doors.

**PART 2 PRODUCTS**

**2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Access Door Materials and Fabrication, General: Provide each access door assembly manufactured as an integral unit, complete with all parts, and ready for installation.

1. If size is not indicated, provide size as directed to adequately access concealed operable mechanisms.
- B. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.
  1. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.
- C. Wall-Mounted Units:
  1. Location: As indicated on drawings.
  2. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
  3. Size: 12 by 12 inches, nominal minimum..
  4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- D. Wall-Mounted Units in Wet Areas:
  1. Location: As indicated on drawings.
  2. Panel Material: Stainless steel, Type 304.
  3. Size: 12 by 12 inches, nominal minimum..
  4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- E. Fire-Rated Wall-Mounted Units:
  1. Location: As indicated on drawings.
  2. Wall Fire-Rating: As indicated on drawings.
  3. Panel Material: Steel.
  4. Size: 12 by 12 inches, nominal minimum.

## **2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS**

- A. Manufacturers:
  1. Activar Construction Products Group, Inc. - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  2. ACUDOR Products Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  3. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  4. Cendrex, Inc: [www.cendrex.com/#sle](http://www.cendrex.com/#sle).
  5. Karp Associates, Inc: [www.karpinc.com/#sle](http://www.karpinc.com/#sle).
  6. Larsen's Manufacturing Co.: [www.larsensmfg.com](http://www.larsensmfg.com).
  7. Milcor, Inc: [www.milcorinc.com/#sle](http://www.milcorinc.com/#sle).
  8. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  9. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Style: Exposed frame with door surface flush with frame surface.
    - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
    - b. Plaster Mounting Criteria: Use plaster bead type frame.
  2. Door Style: Single thickness with rolled or turned in edges.
  3. Frames: 16 gauge, 0.0598 inch, minimum thickness.
  4. Heavy Duty Frames: 14 gauge, 0.0747 inch, minimum thickness.
  5. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
  6. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch back from wall face.
    - a. For recess-mounted access doors, provide access sleeves for each locking device.
    - b. Provide plastic grommets for installation in holes cut through finish.
    - c. Provide recess-mounted doors for concealed installation in:
      - 1) Acoustic tile ceiling systems, where indicated.
      - 2) Acoustical tile-finished gypsum board ceilings, where indicated.
      - 3) Gypsum board walls, where indicated.
      - 4) Ceramic tile walls, where indicated.
  7. Insulation: Non-combustible mineral wool or glass fiber.
  8. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
    - a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
    - b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
  9. Primed and Factory Finish: Polyester powder coat; color \_\_\_\_\_.
  10. Door/Panel Size: As indicated on the drawings.
  11. Hardware:
    - a. Hardware for Fire-Rated Units: As required for listing.
    - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    - c. Latch/Lock: Screw driver slot for quarter turn cam latch.
    - d. Gasketing: Extruded neoprene, around perimeter of door panel.
- C. Provide recess-mounted doors and frames with expanded metal lath for concealed installation in plaster.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.

- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

### **3.03 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Provide for correct termination of adjoining finish materials.
- D. Position units to provide convenient access to concealed equipment when necessary.

### **3.04 ADJUST AND CLEAN**

- A. Adjust access doors and hardware after installation for proper and smooth operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.
- C. Remove protective coverings and clean stainless steel access doors during cleaning for Substantial Completion Review.

### **3.05 SCHEDULES**

- A. Access Door Locations:
  - 1. Provide access doors where indicated on Architectural, Mechanical, Plumbing and Electrical Drawings.
  - 2. Access doors indicated and required for Mechanical, Plumbing and Electrical Work shall be of a type matching those specified in this Section.
  - 3. Provide access doors as required to service building systems and as required by governing authorities, although not shown on Drawings.
    - a. Provide at smoke or fire detector in attic spaces. Size to allow for access and testing.
  - 4. Locate access doors, where practical, in building service areas and not in public or guest view.
  - 5. Submit proposed locations for access doors, not indicated on Drawings, to Architect for review prior to rough-in.
- B. Non-Fire Rated Door and Frame Units in Walls:
  - 1. In Gypsum Board on Studs:
    - a. For service and utility locations, primer paint finish, Model DSC-214M manufactured by Karp.
    - b. For food service, toilet and damp locations, stainless steel, Model DSC-214M manufactured by Karp.
    - c. For Administration, Multi-Purpose and similar areas accessible by general public, recessed face for field-applied and finished plaster on door face, Model RDW manufactured by Karp.



- d. For toilets and locations accessible by general public with ceramic tile wall finish, flush-mounted with face of tile, stainless steel, Model DSB-214M manufactured by Karp.
- C. Non-Fire Rated Door and Frame Units in Ceilings:
  - 1. In Gypsum Board on Metal Furring:
    - a. For service and utility locations, primer paint finish, Model DSC-214M manufactured by Karp.
    - b. For food service, toilet and damp locations, stainless steel, Model DSC-214M manufactured by Karp.
    - c. For Administration, Multi-Purpose and similar areas accessible by general public, recessed face for field-applied and finished plaster on door face, Model RDW manufactured by Karp.
- D. Fire-Rated Access Doors: Access doors in time-rated fire-resistive walls, partitions and ceilings shall carry same rating as the wall, partition or ceiling.
- E. Fire Rated Door and Frame Units in Walls:
  - 1. In Gypsum Board on Studs:
    - a. 1-1/2 hour B label fire rating.
    - b. For public areas, service and utility locations, primer paint finish, surface mounted, filled with 2-inch thick fire-rated insulation, with automatic closer, self-latching bolt-type latch, Model KPR-150FR manufactured by Karp.
    - c. For Food Service, Toilet and other damp locations with ceramic tile finish, stainless steel finish, surface mounted, filled with 2-inch thick fire-rated insulation, with automatic closer, self-latching bolt-type latch, Model KPR-150FR manufactured by Karp.
- F. Fire Rated Door and Frame Units in Ceilings:
  - 1. In Gypsum Board on Metal Furring:
    - a. For typical dry locations, surface mounted, primer paint finish, filled with 2-inch thick fire-rated insulation, with automatic closer, self-latching bolt-type latch, Model KRP-150FR manufactured by Karp.
    - b. For Food Service, Toilet and other damp locations, stainless steel finish, surface mounted, filled with 2-inch thick fire-rated insulation, with automatic closer, self-latching bolt-type latch, Model KPR-150FR manufactured by Karp.
- G. Ceramic Tile Wall Finish

## END OF SECTION

**SECTION 08 32 23**  
**SLIDING AND FOLDING GLAZED WALLS AND DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glazed aluminum sliding wall panel systems, top supported. ALUM-1
- B. Factory fabricated sliding/folding glazed door/wall with frames and operating hardware.
  - 1. Support and operating hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Steel lintels.
- B. Section 07 21 00 - Thermal Insulation: Fibrous stuffing insulation at frame perimeter.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between door frames and adjacent construction.
- D. Section 08 71 00 - Door Hardware: Additional hardware.
- E. Section 08 80 00 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- H. ASTM E413 - Classification for Rating Sound Insulation.
- I. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.
- J. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- K. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide information on dimensions, frame and sill construction, glazing, and hardware.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, and framed opening tolerances.
- D. Samples: Submit two samples, 12 by 12 inch in size illustrating typical frame corner construction, accessories, and finishes.
- E. Submit two samples of door hardware.
- F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in installation of products of type specified, with not less than three years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to project site and store in manufacturer's protective cartons until openings are ready for installation.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

#### **1.07 FIELD CONDITIONS**

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

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Glazed Aluminum Bi-Folding Wall Systems:
  - 1. Arcadia, Inc; 10000 Oasis Series Bi-Folding Aluminum Door: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS**

- A. Performance Requirements: For units mounted in exterior walls and that require weather performance, provide systems that comply with the following:
  - 1. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
  - 2. Water Penetration Resistance; Static Pressure: No uncontrolled water entry on interior face when tested in accordance with ASTM E331 at differential pressure of 5.25 lbf/sq ft.
  - 3. Air Leakage: 0.07 to 0.30 cfm/sq ft maximum leakage at 6.27 psf pressure difference, when tested in accordance with ASTM E283/E283M.
- B. Acoustical Performance: Provide glass partitions and door assemblies tested by qualified testing agency, calculated in accordance with ASTM E413, tested in accordance with ASTM E90, and rated for not less than Sound Transmission Class (STC) indicated.

### **2.03 DESIGN CRITERIA - EXTERIOR SYSTEMS**

- A. Comply with requirements for contractor's design-related professional design services indicated in Section 01 40 00 - Quality Requirements.
- B. Structural Design Criteria: As indicated on drawings.

### **2.04 SLIDING AND FOLDING GLAZED DOORS AND WALLS**

- A. Glazed Aluminum Bi-Folding Wall Panel Systems: Extruded aluminum sliding and fixed wall panel frames, factory fabricated; complete with sill, flashings, and support and anchorage devices.
  - 1. Configuration: Exterior, outward opening, bi-parting with right and left stacking.
  - 2. Support System: Top hung or floor mounted.
  - 3. Standard Sill: Flush type, with sealant, shims and fasteners at necessary locations.
    - a. Finish: To match the panel frame.
  - 4. Weather Performance Sill: Recessed raised type, with sealant, shims and fasteners at necessary locations.
    - a. Finish: To match the panel frame.
    - b. Provide weep holes in sill and drain connections to exterior in accordance with manufacturer's requirements for weather performance indicated.
  - 5. Panel Rail Depth: 2-3/4 inch.
  - 6. Top Rail Height: 4-1/8 inch, square edge.
  - 7. Bottom Rail Height: 5-1/16 inch, square edge.

8. Panel Weight: 264 lbs, maximum.
9. Aluminum Frames: Factory finished; manufacturer's standard corner construction; thermally broken.
10. Drainage: Provide drainage to exterior for moisture entering joints and glazing spaces and for condensation occurring within frame construction.
11. Glass Stops: Same material and color as frame.
12. Aluminum Frame Finish: Anodized coating in accordance with AAMA 611.
  - a. Exterior Color: As scheduled
  - b. Interior Color: As scheduled
- B. Glazing: Double glazed, clear, Low-E coated, manufacturer's standard fill, fully tempered, with glass thickness 1/4 inch.
  1. Unit U-Factor: In compliance with glazing requirements indicated; NFRC 100.
  2. Solar Heat Gain Coefficient (SHGC): In compliance with glazing requirements indicated; NFRC 200.
  3. Setting Blocks: Manufacturer's standard type; complying with ASTM C864.
- C. Sliding Wall Panel Hardware: Manufacturer's standard hardware including carriages with sealed ball bearing rollers, and top or bottom tracks.
  1. Door Hardware: Interior exit device, Lever type exterior, see Section 08 71 00..
  2. Locking Mechanisms: Minimum two-point deadbolt locking of each panel; manufacturer's standard type.
  3. Additional Wall Panel Hardware: Include a key locking mechanism with a cutout in outside escutcheon to accommodate cylinder; see Section 08 71 00.
  4. Hinges: Manufacturer's standard type.
  5. Swing Door Locking: Lever handle lockset with deadbolt into jamb strike; manufacturer's standard type.
    - a. Finish: Manufacturer's standard.
  6. Exposed Hardware Finish: Manufacturer's standard.
- D. Weatherstripping: Manufacturer's standard, continuous and replaceable; provide between exterior doors, panels, frame and track.

## **2.05 FACTORY ASSEMBLY**

- A. Factory assemble sliding/folding operable panel frames as single unit, including head, jambs, and bottom sections; provide concealed fasteners.
  1. Sizes: Allow for tolerances of rough framed openings, clearances, and shims at perimeter of assemblies.
  2. Joints and Corners: Flush, hairline and waterproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  3. Glazing: Factory installed.

## **2.06 ACCESSORIES**

- A. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.
  - 1. Maintain 1-1/2 inch clearance on each side of door handle when open or in closed position.
- B. Anchors: Hot-dipped galvanized or stainless steel in accordance with project and manufacturer's installation requirements.
- C. Sealant for Setting Sills and End Dams: Elastomeric sealant acceptable to door manufacturer.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M, Type I.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that openings are ready to receive work and opening dimensions and clearances are as indicated on approved shop drawings.
- B. Verify that overhead structural supports are adequate and deflection is in compliance with manufacturer's installation requirements.

### **3.02 PREPARATION**

- A. Prepare opening to permit correct installation of door unit in coordination with air and vapor seal.
- B. Apply two coats of bituminous paint with minimum of 16 mils, 0.016 inch dry film thickness (DFT), or as recommended by coating manufacturer, on concealed aluminum surfaces in contact with cementitious or dissimilar materials.
  - 1. Allow bituminous paint to dry prior to installation of aluminum component.
  - 2. Dipping of aluminum into bituminous paint is not permitted.

### **3.03 INSTALLATION**

- A. Install assemblies in accordance with manufacturer's instructions.
- B. Install exterior doors in accordance with ASTM E2112.
- C. Attach frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Use anchorage devices to securely fasten assembly to adjacent construction without distortion or imposed stresses.
- E. Set exterior sills in full bed of sealant, with end dams and non-blocking sill drainage openings.
- F. Install shims at exterior wall sill locations and ensure water dams are not created and sill weep openings are not blocked due to shim placement and orientation.
- G. Provide sealed end dams at exterior wall locations.
- H. Coordinate installation with placement of vapor and/or air seal at frame perimeter as specified in Section 07 25 00.

- I. Coordinate installation of loose fibrous thermal insulation at shim spaces at frame perimeter as specified in Section 07 21 00.
- J. Install perimeter trim.

### **3.04 TOLERANCES**

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

### **3.05 ADJUSTING**

- A. Adjust hardware for smooth operation.

### **3.06 CLEANING**

- A. Comply with requirements of Section 01 74 19 - Construction Waste Management and Disposal.
- B. Remove protective material from factory finished surfaces.
- C. Remove labels and visible markings.
- D. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.
- E. Upon completion of installation, thoroughly clean door aluminum surfaces in accordance with AAMA 609 & 610.
- F. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**

**SECTION 08 43 13**  
**ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass. ALUM-1
- B. Infill panels of glass.
- C. Aluminum doors and frames.
- D. Weatherstripping.
- E. Perimeter sealant.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Steel attachment devices.
- B. Section 07 25 00 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- E. Section 08 80 00 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.



- K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Structural and Energy design of the system has already been used as a basis of approval by City Building Department and other agencies. If a substitution is proposed, then the Contractor is responsible for the re-approval of the documents in a timely manner within the original project schedule, along with all professional and agency fees related to this substitution. See Section 01 60 00 - Product Requirements.
- C. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
  - 1. Include construction details and fabrication methods, profiles and dimensions of individual components, data on hardware, accessories, and finishes.
  - 2. Energy Model Submissions
    - a. Provide a copy of the project ENV-1 form.
    - b. Provide evidence that the proposed products can meet or exceed the energy values listed on the ENV-1 form. Preferred method is an NFRC site certificate, but a simulation report by an independent NFRC certified simulator will be considered. *AAMA test reports and or simulations will not be accepted as they are not allowed under the current code.*
    - c. Provide a statement of who will be the "responsible party" in issuing the NFRC site certificates.
- D. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
  - 1. Complete, indicating elevation views of all units, attachments to surrounding construction of Project, type of glazing, and all door hardware and weatherstripping. All Shop Drawings shall be prepared by manufacturer and shall include manufacturer's logo.
- E. Samples: Submit two samples 2 x 3 inches in size illustrating finished aluminum surface, glass, glazing materials.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- H. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- I. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

- J. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- K. Manufacturer's qualification statement.
- L. Installer's qualification statement.

#### **1.06 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with Code requirements for safety glazing, accessibility and exit devices.
  - 1. Conform to applicable requirements of the Americans with Disabilities Act Accessibility Guidelines regarding accessibility requirements for door and entrance hardware.
  - 2. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.
  - 3. Exit devices shall comply with CBC Section 1010.1.9.1 and 11B-404.2.7. Lever handle trim shall match locksets.
  - 4. Conform to applicable requirements of Title 24, Part 2, CCR, including Sections 11B-404.2.7, 11B-404.2.9, and 1010.1.9, regarding exiting and accessibility requirements for door and entrance hardware.
  - 5. Exterior doors to have 5 pounds maximum pressure to open and interior doors to have 5 pounds maximum pressure to open. The maximum effort to operate fire doors may be increased to the maximum allowable by the appropriate administrative authority, but in no case shall the pressure exceed 15 pounds. CBC 11B-404.2.9.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.
- D. Single-Source Responsibility: All entrances and storefront framing and doors, including finish, shall be the product of one manufacturer.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
  - 1. Store storefront sections out of contact with the ground and under a weather tight covering. Do not cover storefront sections with polyethylene film or similar coverings that will create a humidity chamber.
  - 2. Protect surfaces during shipping and handling to prevent scratching, gouging or other damage to the finish.

#### **1.08 FIELD CONDITIONS**

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

#### **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

- B. All doors shall carry manufacturer's lifetime warranty on door corner construction, provided in writing.
- C. Correct defective Work within a five year period after Date of Substantial Completion.
- D. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- E. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Aluminum-Framed Storefronts:
  - 1. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
    - a. For any product not identified as "Basis of Design", submit information as specified for substitutions.
    - b. Substitution may or may not be accepted after Architect and Owner review with complete evaluation for content and schedule impact.
    - c. Substitutions shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
      - 1) Revision to shop drawings illustrating changes is not considered adequate for AHJ review and approval.
      - 2) A minimum fee of \$10,000.00 for AHJ review processing by the Architect will need to be included for additional AHJ review of any substituted system other than the basis of design.
      - 3) An additional minimum allowance of \$10,000.00 is required for Architect's time to review the substituted system prior to submitting for governing agency approval.
      - 4) The indicated fee amounts are minimums. These are subject to increase pending Architect and AHJ reviews of the proposed substitution.
    - d. Substitutions may be acceptable, based on Architect's review and approval, for submittal to AHJ.
      - 1) If substituted manufacturer cannot reproduce design and AHJ approval in a timely manner, then they shall be subject to a time and material back charge for any delays in the project.
      - 2) Architect approval is required prior to AHJ submittal and AHJ approval is required prior to installation.

### **2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING**

- A. Front-Set Style, Thermally-Broken:
  - 1. Basis of Design: Arcadia Corp; Offset Glazed System AFG451 Series - Non-Thermal - Shear Block Inside Set: [www.arcadiainc.com](http://www.arcadiainc.com).

2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

### **2.03 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING**

- A. Center-Set Style:
  1. Basis of Design: Arcadia Corp; Center Glazed System AR600 Series - Non-Thermal - Shear Block Outside Set: [www.arcadiainc.com](http://www.arcadiainc.com).
  2. Vertical Mullion Dimensions: 2 inches wide by 6 inch deep.

### **2.04 BASIS OF DESIGN -- SWINGING DOORS**

- A. Medium Stile, Insulating Glazing, Thermally-Broken:
  1. Basis of Design: Arcadia Corp; MS362 Series Medium Stile: [www.arcadiainc.com](http://www.arcadiainc.com).
  2. Thickness: 1-3/4 inches.

### **2.05 ALUMINUM-FRAMED STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  1. Glazing Rabbet: For 1 inch insulating glazing.
  2. Glazing Rabbet: For 1/4 inch monolithic glazing.
  3. Finish: Class I color anodized.
    - a. Factory finish all surfaces that will be exposed in completed assemblies.
    - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
    - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  4. Finish Color: As indicated on the drawings.
  5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.
  12. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    - a. Design Wind Loads: Comply with requirements of ASCE 7.
    - b. Member Deflection: Limit member deflection to flexure limit of glass or 1/175 of span, maximum 3/4 inch (over 11'-0" span), in any direction, with full recovery of glazing materials.
  2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 12 psf.
  3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
  4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
  5. Energy Performance:
    - a. NFRC Values:
      - 1) U-Value: 0.41.
      - 2) Solar Heat Gain Coefficient: 0.34.
      - 3) Visible Transmittance: 0.61.
    - b. The Owner has used NFRC certified values for the analysis of this building. It does not allow for the use of CCR Title 24 default values.
    - c. Provide products that meet or exceed the U-factor and S.H.G.C. values listed on the ENV-1 form, filed in the contract documents elsewhere.
    - d. AAMA ratings are not allowed under CCR Title 24 and will not be acceptable.
  6. Resistance to Forcible Entry: Jambs adjacent to door locks shall resist a force of 1600 pounds.

## **2.06 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
  2. Glazing Stops: Flush.
  3. Cross-Section: As indicated on drawings.
  4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: See Section 08 80 00.

1. For Exterior Framing: Type IG-1.
  2. For Interior Framing: Type S-1.
- C. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches.
  2. Top Rail: 5-1/8 inches wide, nominal.
  3. Vertical Stiles: 5 inches wide, nominal. Coordinate with hardware for a complete installation.
  4. Bottom Rail: 10 inches high, minimum.
  5. Glazing Stops: Beveled.
  6. Finish: Same as storefront.

## **2.07 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.
- D. Fasteners: Stainless steel.
- E. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
- F. Concealed Flashings: Galvanized steel, 26 gauge, 0.0179 inch minimum base metal thickness.
- G. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- H. Sealant for Setting Thresholds: Non-curing butyl type.
- I. Perimeter Sealant: Type as specified in Section 07 92 00 - Joint Sealants.
- J. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
1. All storefront systems shall include "top-load" glazing gaskets.
- K. Glazing Accessories: See Section 08 80 00.
- L. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.
- M. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

## **2.08 FINISHES**

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.
- B. Color: As indicated on drawings.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **2.09 HARDWARE**

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Door Hardware for Aluminum Entrances and Storefronts:

1. Install standard door hardware as specified in this Section and custom hardware and door thresholds as specified in Section 08 71 00 - Door Hardware.
  2. Hardware shall not require tight gripping, pinching or twisting of the wrist.
  3. Mounting heights as indicated on Section 08 71 00 Door Hardware.
- C. Other Door Hardware: See Section 08 71 00.
- D. Weatherstripping: manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D2000 or molded PVC complying with ASTM D2287, continuous and replaceable; provide on all exterior doors.
1. Provide manufacturer's optional bottom rail weathering strip.
  2. Retainer finish to match door.
- E. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- F. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

#### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
  1. Anchoring: Firmly anchor framing using fasteners as recommended by manufacturer, sized to suit loads and type suitable for substrate, to positively attach members for long life under hard use.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
  1. Comply with requirements specified in Section 07 62 00 - Sheet Metal Flashing and Trim. Set sill flashing in bedding sealant as specified in Section 07 92 00 - Joint Sealants.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Door Installation: Assemble doors in shop with glazing installed.

1. Door Joints: Make joints rigid and suitable for heavy use.
- K. Set thresholds in bed of sealant and secure.
- L. Install glass in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
- M. Install perimeter sealant in accordance with Section 07 92 00 - Joint Sealants.
- N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

### **3.04 FIELD QUALITY CONTROL**

- A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 01 40 00 - Quality Requirements for general testing and inspection requirements.
- C. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
  1. Perform a minimum of two tests in each designated area as directed by Architect.
  2. Conduct tests in each area prior to 10 percent, 35 percent, and 70 percent completion of this work.
  3. Testing: Installing Contractor to water test all storefront and glazing in the presence of the IOR by spraying with hose heavily for 5 minutes. Repair all leaks discovered by testing procedures and repeat test until leak-free performance is achieved.
  4. Provide written report to Architect and IOR.
- D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

### **3.05 ADJUSTING**

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

### **3.06 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

## **END OF SECTION**



**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.
- B. Perimeter sealant.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Weld plates embedded in concrete for attachment of anchors.
- B. Section 05 12 00 - Structural Steel Framing: Steel attachment members.
- C. Section 05 50 00 - Metal Fabrications: Steel attachment devices.
- D. Section 07 25 00 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.
- E. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- F. Section 08 43 13 - Aluminum-Framed Storefronts: Entrance framing and doors.
- G. Section 08 80 00 - Glazing.
- H. Section 09 21 16 - Gypsum Board Assemblies: Metal stud and gypsum board wall at interior of curtain wall.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
- B. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
- C. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- D. AAMA 501.4 - Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift.
- E. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).
- F. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- G. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- H. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual.
- I. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- J. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

- L. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- N. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- O. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- P. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- Q. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- R. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- S. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).
- T. CBC Chapter 20 - Aluminum.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting three weeks before starting work of this section; require attendance by all affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Structural and Energy design of the system has already been used as a basis of approval by City Building Department and other agencies. If a substitution is proposed, then the Contractor is responsible for the re-approval of the documents in a timely manner within the original project schedule, along with all professional and agency fees related to this substitution. See Section 01 60 00 - Product Requirements.
- C. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing special installation requirements, and infill.
  - 1. Energy Model Submissions
    - a. Provide a copy of the project ENV-1 form.
    - b. Provide evidence that the proposed products can meet or exceed the energy values listed on the ENV-1 form. Preferred method is an NFRC site certificate, but a simulation report by an independent NFRC certified simulator will be considered. *AAMA test reports and or simulations will not be accepted as they are not allowed under the current code.*
    - c. Provide a statement of who will be the “responsible party” in issuing the NFRC site certificates.

- D. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work, expansion and contraction joint location and details, and field welding required.
- E. Samples: Submit two samples 4 by 4 inches in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- H. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.
- I. Report of field testing for water leakage after installation.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.
- L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at California.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

#### **1.07 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide full height by 8 feet wide mock-up including each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
- C. Locate where directed.
- D. Mock-up may remain as part of work.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
  - 1. Store curtain wall sections out of contact with the ground and under a weather tight covering. Do not cover storefront sections with polyethylene film or similar coverings that will create a humidity chamber.

2. Protect surfaces during shipping and handling to prevent scratching, gouging or other damage to the finish.

#### **1.09 PROJECT CONDITIONS**

- A. Field Measurements: Take field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

#### **1.10 SEQUENCING AND SCHEDULING**

- A. Scheduling installation of the glazed aluminum curtain wall system in sequence with related elements of the work specified in other Sections to endure that wall assemblies, including flashing, trim, and joint sealers, are protected against damage from effects of weather, age, corrosion, and other causes.

#### **1.11 FIELD CONDITIONS**

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

#### **1.12 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with installer.
- C. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- D. All doors shall carry manufacturer's lifetime warranty on door corner construction, provided in writing.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with CBC and California State Fire Marshall requirements for safety glazing, accessibility and exit devices.
- B. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.
- C. Exit devices shall comply with CBC Section 1010.1.9. Lever handle trim shall match locksets.
- D. Conform to applicable requirements of the Americans with Disabilities Act Accessibility Guidelines regarding accessibility requirements for door and entrance hardware.
- E. Conform to applicable requirements of Title 24, Part 2, CCR, including Sections 11B-404.2.7 Door and Gate Hardware, 11B-404.2.9 Door and Gate Opening Force, and 1010.1.9 Door Operation, regarding exiting and accessibility requirements for door and entrance hardware.

- F. Exterior doors to have 5 pounds maximum pressure to open and interior doors to have 5 pounds maximum pressure to open. The maximum effort to operate fire doors may be increased to the maximum allowable by the appropriate administrative authority, but in no case shall the pressure exceed 15 pounds.

## **2.02 BASIS OF DESIGN - CURTAIN WALL SYSTEMS**

- A. Pressure Cap Four Sides; Not Unitized, Field Assembled:
  - 1. Basis of Design: Arcadia, Inc.; T-500 Series, OPG-1900, 2-1/4 inch wide face: [www.arcadiainc.com](http://www.arcadiainc.com).
- B. Substitutions: See Section 01 60 00 - Product Requirements.
  - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.
  - 2. Substitution may or may not be accepted after Architect and Owner review with complete evaluation for content and schedule impact.
  - 3. Substitutions shall include all costs for redesign with consequential changes by other Contractor trades along with the Architect and related approvals by governing agencies.
    - a. Revision to shop drawings illustrating changes is not considered adequate for AHJ review and approval.
    - b. A minimum fee of \$10,000.00 for AHJ review processing by the Architect will need to be included for additional AHJ review of any substituted system other than the basis of design.
    - c. An additional minimum allowance of \$10,000.00 is required for Architect's time to review the substituted system prior to submitting for governing agency approval.
    - d. The indicated fee amounts are minimums. These are subject to increase pending Architect and AHJ reviews of the proposed substitution.
  - 4. Substitutions may be acceptable, based on Architect's review and approval, for submittal to AHJ.
    - a. If substituted manufacturer cannot reproduce design and AHJ approval in a timely manner, then they shall be subject to a time and material back charge for any delays in the project.
    - b. Architect approval is required prior to AHJ submittal and AHJ approval is required prior to installation.

## **2.03 CURTAIN WALL**

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Fabrication Method: Field fabricated stick system.
  - 2. Glazing Method: Field glazed system.
  - 3. Finish: Class I color anodized.
    - a. Factory finish surfaces that will be exposed in completed assemblies.
    - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

- c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- 4. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
- 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
- 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- 7. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
- 8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- 9. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
  - 1. Design Wind Loads: Comply with the requirements of ASCE 7
    - a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
    - b. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch (over 11'-0" span), whichever is less and with full recovery of glazing materials.
    - c. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.
  - 2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7.
  - 3. Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4 for Use Group I, Standard Occupancy, when tested at design displacement of 0.010 times greater adjacent story height, maximum, and 1.5 times design displacement, through three complete cycles.
    - a. Comply with DSA IR 24-2.
    - b. Include inter-story drift in results. See Structural Drawings general notes.
  - 4. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    - a. Expansion and contraction caused by 180 degrees F surface temperature.
    - b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
    - c. Movement of curtain wall relative to perimeter framing.

- d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
  - 1. Test Pressure Differential: 10 psf.
  - 2. Test Method: AAMA 501.1.
- D. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf pressure difference across assembly.
- E. Thermal Performance Requirements:
  - 1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

## **2.04 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
  - 1. Framing members for interior applications need not be thermally broken.
  - 2. Cross-Section: As indicated on drawings.
  - 3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
  - 4. Aluminum tubes for Sun Control Support: Provide and install additional integrated aluminum tube sections for support of sun control brackets and their associated loads.
- B. Glazing: See Section 08 80 00.
  - 1. For Exterior Framing: Type IG-1.
- C. Aluminum Entrance Doors and Hardware
  - 1. See Section 08 43 13 for doors and hardware.

## **2.05 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- D. Structural Supporting Anchors: See Section 05 12 00.
- E. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.
- F. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
- G. Exposed Flashings: Aluminum sheet, 20-gauge, 0.032-inch minimum thickness; finish to match framing members.
- H. Concealed Flashings: Sheet aluminum, 26-gauge, 0.017-inch minimum thickness.
- I. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.
- J. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

- K. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
  - 1. Manufacturer's standard permanent framing system gaskets and joint fillers, depending on joint movement and sealing requirements, such as sliding joints, compression joint translation, or non-moving joints. Inside glazing face to receive closed cell neoprene sponge gaskets (ASTM C509). Exterior glazing seal gasket shall be fixed resilient elastomeric EPDM glazing spline.
- L. Glazing Accessories: See Section 08 80 00.
- M. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.
- N. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

## **2.06 FINISHES**

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.
- B. Color: As indicated on drawings.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **2.07 FABRICATION**

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

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.



### **3.02 INSTALLATION**

- A. Install curtain wall system in accordance with manufacturer's instructions and AAMA CW-DG-1.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings at all sill conditions. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Internal wiring:
  - 1. Wiring routed through mullions shall be by installer with immediate oversight by related smoke control, fire alarm system, and low-voltage system SubContractors. Connections shall be load tested with the correct devices at each appropriate stage of sub-assembly to prior to and after final assembly.
  - 2. Failed wiring connections shall be replaced at no additional cost to Owner.
- J. Pressure Plate Framing: Install glazing in accordance with Section 08 80 00, using exterior dry glazing method.
- K. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet noncumulative or 0.5 inches per 100 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.
  - 1. Curtain wall manufacturer shall provide field surveillance of the installation of their products.
  - 2. Inspect, monitor and report installation procedures and unacceptable conditions to Architect and Owner Representative.

- B. See Section 01 40 00 - Quality Requirements for general testing and inspection requirements.
- C. Water-Spray Test: Provide water spray quality test by Contractor of installed curtain wall components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
  - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
  - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
- D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

### **3.05 ADJUSTING**

- A. Adjust operating sash for smooth operation.

### **3.06 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective material from pre-finished aluminum surfaces.
- C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.
- D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.
- E. Remove excess sealant by method acceptable to sealant manufacturer.
- F. Glass Cleaning: See Section 08 80 00 - Glazing.

### **3.07 PROTECTION**

- A. Protect installed products from damage until mm-dd-yyyy.

**END OF SECTION**

## **SECTION 08 71 00 DOOR HARDWARE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Hardware for hollow metal doors.
- B. Hardware for fire-rated doors.
- C. Electrically operated and controlled hardware.
- D. Lock cylinders for doors that hardware is specified in other sections.
- E. Thresholds.
- F. Weatherstripping and gasketing.
- G. Replacement hardware for existing doors.
- H. Gate hardware as noted.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 41 00 - Architectural Wood Casework: Cabinet hardware.
- B. Section 07 92 00 - Joint Sealants: Sealants for setting exterior door thresholds.
- C. Section 08 06 71 - Door Hardware Schedule: Schedule of door hardware sets.
- D. Section 08 11 13 - Hollow Metal Doors and Frames.
- E. Section 08 14 16 - Flush Wood Doors.
- F. Section 08 43 13 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.
- G. Section 10 14 23 - Panel Signage: Additional signage requirements.
- H. Section 10 26 00 - Wall and Door Protection: Door and frame protection.
- I. Section 28 10 00 - Access Control: Electronic access control devices.
- J. Section 28 46 20 - Fire Alarm System: Electrical connection to activate door closers.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. BHMA (CPD) - Certified Products Directory.
- C. BHMA A156.1 - Standard for Butts and Hinges.
- D. BHMA A156.2 - Bored and Preassembled Locks and Latches.
- E. BHMA A156.3 - Exit Devices.
- F. BHMA A156.4 - Door Controls - Closers.
- G. BHMA A156.5 - Cylinders and Input Devices for Locks.
- H. BHMA A156.6 - Standard for Architectural Door Trim.
- I. BHMA A156.7 - Template Hinge Dimensions.

- J. BHMA A156.13 - Mortise Locks & Latches Series 1000.
- K. BHMA A156.16 - Auxiliary Hardware.
- L. BHMA A156.17 - Self Closing Hinges & Pivots.
- M. BHMA A156.20 - Standard for Strap and Tee Hinges, and Hasps.
- N. BHMA A156.21 - Thresholds.
- O. BHMA A156.22 - Standard for Gasketing.
- P. BHMA A156.26 - Standard for Continuous Hinges.
- Q. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems.
- R. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- S. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames.
- T. CBC Ch. 11B - California Building Code-Chapter 11B.
- U. DHI (H&S) - Sequence and Format for the Hardware Schedule.
- V. DHI (KSN) - Keying Systems and Nomenclature.
- W. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
- X. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors.
- Y. ITS (DIR) - Directory of Listed Products.
- Z. NFPA 70 - National Electrical Code.
- AA. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- BB. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- CC. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- DD. UL (DIR) - Online Certifications Directory.
- EE. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
- FF. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
  - 1. Architect.
  - 2. Installer's Architectural Hardware Consultant (AHC).
  - 3. Hardware Installer.
  - 4. Owner's Security Consultant.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

- E. Keying Requirements Meeting:
1. Schedule meeting at project site prior to Contractor occupancy.
  2. Attendance Required:
    - a. Contractor.
    - b. Owner and relevant staff.
    - c. Architect.
    - d. Installer's Architectural Hardware Consultant (AHC).
    - e. Hardware Installer.
    - f. Owner's Security Consultant.
  3. Agenda:
    - a. Establish keying requirements.
    - b. Verify locksets and locking hardware are functionally correct for project requirements.
    - c. Verify that keying and programming complies with project requirements.
    - d. Establish keying submittal schedule and update requirements.
  4. Contractor to provide a blank key schedule in excel format for Owner review and approval prior to formal submittal.
  5. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
    - a. Access control requirements.
    - b. Key control system requirements.
    - c. Schematic diagram of preliminary key system.
  6. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
    - a. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
  7. Deliver established keying requirements to manufacturers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work
- C. 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.
  1. Submittals prepared without thorough jobsite visit by qualified hardware expert may be rejected as non-compliant.

- D. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- E. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
  - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
    - a. Submit in vertical format; see Section 08 0671.
  - 3. List groups and suffixes in proper sequence.
  - 4. Provide complete description for each door listed.
  - 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
  - 6. Include account of abbreviations and symbols used in schedule.
- F. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
  - 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
  - 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- G. Samples for Verification:
  - 1. Submit minimum size of 2 by 4 inch for sheet samples, and minimum length of 4 inch for other products.
  - 2. Submit one (1) sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
  - 3. Return full-size samples to be incorporated into this Work.
  - 4. Submit product description with samples.
- H. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- I. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
  - 1. Submit manufacturer's parts lists and templates.
  - 2. Bitting List: List of combinations as furnished.
- J. Keying Schedule:

1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- K. Manufacturer's qualification statement.
- L. Installer's qualification statement.
- M. Supplier's qualification statement.
- N. Owner Responsibilities for submittal review:
  1. Complete keying schedule.
  2. Complete keying legend.
  3. Provide original letter of authorization allowing hardware supplier to purchase keying hardware and to have the bitting list sent to Owner.
  4. Provide Owner the locksmith's name, address, phone number and email.
  5. Identify how doors are to be keyed.
  6. For existing systems, provide the registry number.
- O. Manufacturers' certificates that fire-rated hardware meets or exceeds specified requirements.
- P. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
  1. Include keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report
- Q. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Lock Cylinders: Ten for each master keyed group.
  3. Temporary Cores: Return to and receipt by Contractor.
  4. Tools: Two sets of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

#### **1.06 QUALITY ASSURANCE**

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

### **1.08 PROJECT CONDITIONS AND COORDINATION:**

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination:
  - 1. Coordinate hardware with other work.
  - 2. Provide hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
  - 3. Furnish related trades with the following information:
    - a. Location of embedded and attached items to concrete.
    - b. Location of wall-mounted hardware, including wall stops.
    - c. Location of finish floor materials and floor-mounted hardware.
    - d. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items.
      - 1) Fire/life-safety system interfacing.
      - 2) Point-to-point wiring diagrams plus riser diagrams to related trades.
    - e. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
    - f. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

### **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
  - 1. Mechanical Closers: Thirty years, minimum.
  - 2. Mechanical Exit Devices: Five years, minimum.
  - 3. Key Blanks: Lifetime
  - 4. Hardware: One year, minimum.
- C. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

## **PART 2 PRODUCTS**

### **2.01 DESIGN AND PERFORMANCE CRITERIA**

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.



- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Regulatory Requirements:
  - 1. Fire-Rated Openings: Comply with NFPA 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels. California State Fire Marshal Standard 12-7-4
    - a. Where exit devices are required on fire rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide UL label on exit device indicating "Fire Exit Hardware".
  - 2. Comply with State Fire Marshal Standards.
    - a. Lever of lever actuated latches or locks shall be curved with a return to within 1/2 inch of the door to prevent catching on the clothing of persons during egress. SFM 12-10-2 Latching/Locking, Section 12-10-202(f).
    - b. The cross-bar shall extend across not less than one-half the width of the door/gate. 12-10-3 Exits, Section 12-10-302(a).
    - c. The ends of the cross-bar shall be curved, guarded or otherwise designed to prevent catching on the clothing of persons during egress. SFM 12-10-3 Exits, Section 12-10-302(d).
  - 3. Conform to applicable requirements of the CBC Chapter 11B and ADA Standards regarding accessibility requirements for door and entrance hardware including gates.
    - a. Doors/doorways as part of an accessible route shall comply with CBC Sections 11B-404.
    - b. Doors shall meet California Building Code Sections 11B-206.5, 11b-404.1 and 1010.1.
    - c. The clear opening width for a door shall be 32 inches minimum. CBC Section 11B-404.2.3
      - 1) For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees.
      - 2) There shall be no projections into it below 34 inches and 4 inches maximum projections into it between 34 inches and 80 inches above the finish floor or ground.
      - 3) Door closers and stops shall be permitted to be 78 inches minimum above the finish floor or ground.
      - 4) Exception: Doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.
    - d. 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.
      - 1) Operable parts of such hardware shall be 34 inches minimum and 44 inches maximum above finish floor or ground.
      - 2) Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both side. CBC Section 11B-404.2.7

- e. The force for pushing or pulling open a door shall be as follows : CBC Section 11B-404.2.9.
  - 1) Interior Hinged Doors, sliding or folding doors, and exterior hinged doors: 5 lbs maximum.
  - 2) Required Fire Doors: the minimum opening force allowable by the AHJ authority, not to exceed 15 lbs..
  - 3) 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.
  - 4) The force required to activate any operable parts, such as retracting latch bolts or disengaging other devices, shall be 5 lbs. maximum to comply with CBC Section 11B-309.4.
- f. Door closing speed shall be as follows: CBC Section 11B-404.2.8
  - 1) 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 minimum.
  - 2) 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.
- g. Thresholds shall comply with CBC Section 11B-404.2.5.
- h. Floor stops shall not be located in the path of travel and 4 inches maximum from walls.
- i. Hardware (including exit devices) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met.
  - 1) Such hardware has a 'dogging' feature.
  - 2) It is dogged during the time the facility is open.
  - 3) Such 'dogging' operation is performed only by employees as their job function (non-public use).
- j. 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
- 4. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door, including the hardware, may not encroach or project more than 7 inches into the required exit width. California Building Code 1005.7.1.
- D. Provide door hardware products that comply with the following requirements:
  - 1. Applicable provisions of federal, state, and local codes.
  - 2. Accessibility: ADA Standards, CBC Chapter 11B.
  - 3. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
  - 4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

- a. Latching hardware, door closers, ball bearing hinges, and seals are required whether listed in the Hardware Schedule or not.
- 5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
  - a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf of door opening at 0.10 inch of water for both ambient and elevated temperature tests.
- 6. Listed and certified compliant with specified standards by BHMA (CPD).
- 7. Auxiliary Hardware: BHMA A156.16.
- 8. Straps and Tee Hinges: BHMA A156.20.
- 9. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
- 10. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
- 11. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- E. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
  - 1. See Section 28 10 00 for additional access control system requirements.
- F. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.
  - 1. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.
- G. Fasteners:
  - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    - a. Aluminum fasteners are not permitted.
    - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
  - 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    - a. Self-drilling (Tek) type screws are not permitted.
  - 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
  - 4. Coordinate With Doors: Ensure provision of proper blocking to support wood screws at wood doors and machine screws at metal doors/frames to mounting panic hardware and door closers.
  - 5. No through-bolts are allowed on any door type.
  - 6. Fire-Rated Applications: Comply with NFPA 80.

- a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
  - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
- 7. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

## 2.02 HINGES

- A. Manufacturers:
  - 1. Basis of Design: McKinney (MK) - TA/T4A Series, 5-knuckle.
  - 2. McKinney; an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 3. Pemko; an Assa Abloy Group company; Continuous Hinge: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 4. Substitutions: Not permitted.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
  - 1. Self Closing Hinges: Comply with BHMA A156.17.
  - 2. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
    - a. Provide hinge width required to clear surrounding trim.
    - b. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable.
      - 1) Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening.
      - 2) Advise Architect if 8 inch width is insufficient.
    - c. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled.
      - 1) Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
    - d. Conventional Hinges: Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
  - 3. Continuous Hinges: Comply with BHMA A156.26 Grade 1-600 continuous geared hinge.
    - a. Geared-type aluminum.
      - 1) Use wide-throw units where needed for maximum degree of swing, advise Architect if commonly available hinges are insufficient.
      - 2) If units are used at storefront openings, color-coordinate hinge finish with storefront color.
        - (a) Custom anodizing and custom powdercoat finishes subject to Architect approval.
    - b. Pinned steel/stainless steel type: continuous stainless steel, 0.25-inch diameter stainless-steel hinge pin.

- 1) Use engineered application-specific wide-throw units as needed to provide maximum swing degree of swing, advise Architect if required width exceeds 8 inches.
4. Provide hinges on every swinging door.
5. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
6. Provide ball-bearing hinges at each door with closer.
7. Provide non-removable pins on exterior outswinging doors.
  - a. Out-swinging exterior doors: Non-ferrous with non-removable (NRP) pins and security studs.
  - b. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
8. Provide non-removable pins on interior outswinging doors at locations as indicated in Door Hardware Schedule.
9. Provide power transfer hinges where electrified hardware is mounted in door leaf.
  - a. Basis of Design: Scheduled Manufacturer: Securiton EL-CEPT.
  - b. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
  - c. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.
  - d. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
    - 1) Manufacturers:
      - (a) McKinney (MK) - QC (# wires) Option.
  - e. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
    - 1) Manufacturers:
      - (a) Pemko (PE) - EL-CEPT Series.
      - (b) Securiton (SU) - EL-CEPT Series.

- f. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
  - 1) Provide one each of the following tools as part of the base bid contract:
    - (a) McKinney (MK) - Electrical Connecting Kit: QC-R001.
    - (b) McKinney (MK) - Connector Hand Tool: QC-R003.
  - 2) Manufacturers:
    - (a) McKinney (MK) - QC-C Series.
10. Provide following quantity of butt hinges for each door:
  - a. Doors up to 60 inches High: Two hinges.
  - b. Doors From 60 inches High up to 90 inches High: Three hinges.
  - c. Doors 90 inches High up to 120 inches High: Four hinges.

### **2.03 AUTO FLUSH BOLTS**

- A. Manufacturers:
  1. Door Controls International: [www.doorcontrols.com](http://www.doorcontrols.com).
  2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Substitutions: Not permitted.
- B. Automatic Flush Bolts: Comply with BHMA A156.16, Grade 1.
  1. Flush Bolt Throw: 3/4 inch, minimum.
  2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
    - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
  3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
  4. Manual Flush Bolts: Not permitted.
  5. Automatic Flush Bolts: Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened; located on inactive leaf of pair of doors.

### **2.04 EXIT DEVICES**

- A. Manufacturers:
  1. Basis of Design: 6000 Series.
  2. ASSA ABLOY ACCENTRA, formerly known as Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Substitutions: Not permitted.

- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
  2. Provide cylinder with cylinder dogging or locking trim on fire non-rated doors.
  3. Provide exit devices properly sized for door width and height.
  4. Provide strike as recommended by manufacturer for application indicated.
  5. Releasable in normal operation with 5-lb. maximum operating force per CBC Ch. 11B-309.4.
  6. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate.
  7. Comply with CBC Section 1010.2.9 and State Fire Marshal Standard 12-10-3 Exits, Section 12-10-302.
  8. Trim to meet BHMA A156.3 Trim Security Test.
  9. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
  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. See also Section 08 11 13 - Hollow Metal Doors and Frames.
  11. For electrical options, provide quick connect plug-in pre-wired connectors.

## **2.05 LOCK CYLINDERS**

- A. Manufacturers:
1. ASSA ABLOY ACCENTRA, formerly known as Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. Substitutions: Not permitted.
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide standard, electronic, conventional, and full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
  2. Provide cylinders from same manufacturer as locking device.
  3. Provide cams and/or tailpieces as required for locking devices.
  4. Furnish keyed at factory of lock manufacturer where permanent records are maintained.
  5. Locks and cylinders by the same manufacturer.
  6. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

## **2.06 CYLINDRICAL LOCKS**

- A. Manufacturers:
1. Basis of Design: 4700LN Series.

2. ASSA ABLOY ACCENTRA, formerly known as Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
1. Bored Hole: 2-1/8 inch diameter.
  2. Latchbolt Throw: 1/2 inch, minimum.
  3. Backset: 2-3/4 inch unless otherwise indicated.
  4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    - a. Finish: To match lock or latch.
    - b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
    - c. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.
    - d. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
  5. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

## **2.07 MORTISE LOCKS**

- A. Manufacturers:
1. Basis of Design: 8800FL Series.
  2. ASSA ABLOY ACCENTRA, formerly known as Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Substitutions: Not permitted.
- B. Mortise Locks: Complying with BHMA A156.13, Grade 1.
1. Latchbolt Throw: 3/4 inch, minimum.
  2. Deadbolt Throw: 1 inch, minimum.
  3. Backset: 2-3/4 inch unless otherwise indicated.
  4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    - a. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
    - b. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.
    - c. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
    - d. Rabbet Front and Strike: Provide on locksets for use with rabbeted meeting rails.
    - e. Finish: To match lock or latch.



5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
  - a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
  - b. Inside lever applied by screwless shank mounting – no exposed trim mount screws.
  - c. Levers rotate up or down for ease of use.
  - d. 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.
    - 1) Lever Design: Schlage 06A.
    - 2) Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
6. 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.
7. Provide motor based electrified locksets with electrified options as scheduled in the hardware sets and comply with the following requirements:
  - a. Universal input voltage – single chassis accepts 12 or 24V DC to allow for changes in the field without changing lock chassis.
  - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
  - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
  - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
  - e. Request to Exit Switch (RX) –
    - 1) Modular Design – provide electrified locks capable of using, adding, or changing a modular RX switch without opening the lock case.
    - 2) Monitoring – where scheduled, provide a request to exit (RX) switch that detects rotation of the inside lever.
  - f. Connections – provide quick-connect Molex system standard.

## **2.08 DOOR PULLS AND PUSH PLATES**

- A. Manufacturers:
  1. Basis of Design: Rockwood.
  2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Substitutions: Not permitted.
- B. Door Pulls and Push Plates: Comply with BHMA A156.6.
  1. Pull Type: Straight, unless otherwise indicated.

2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
  - a. Edges: Beveled, unless otherwise indicated.
3. Material: Stainless steel, unless otherwise indicated.
4. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
5. On solid doors, provide matching door pull and push plate on opposite faces.
6. On glazed storefront doors, provide matching door pulls/push plates on both faces unless otherwise indicated.

## **2.09 DOOR PULLS AND PUSH BARS**

- A. Manufacturers:
  1. Basis of Design: Rockwood.
  2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Door Pulls and Push Bars: Comply with BHMA A156.6. Size, shape, and material as indicated in the hardware sets.
  1. Bar Type: Bar set, unless otherwise indicated.
  2. Material: Stainless steel, unless otherwise indicated.

## **2.10 CLOSERS**

- A. Manufacturers; Surface Mounted:
  1. Basis of Design: ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 4400 Series; or Norton Rixson (NO) - 7500 Series.
  2. Norton, Rixson, or ASSA ABLOY ACCENTRA, formerly known as Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Substitutions: Not permitted.
- B. Closers: Comply with BHMA A156.4, Grade 1.
  1. Type: Surface mounted to door.
  2. Provide door closer on each exterior door.
  3. Provide door closer on each fire-rated and smoke-rated door.
    - a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
  4. Operating Force: Adjustable to maximum 5 lbs operating force. Comply with ADA Standards and CBC Ch. 11B.
  5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
  6. At corridor entry doors, mount closer on room side of door.
  7. At outswinging exterior doors, mount closer on interior side of door.

## **2.11 PROTECTION PLATES**

- A. Manufacturers:
  - 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Protection Plates: Comply with BHMA A156.6.
- C. Metal Properties: Stainless steel.
  - 1. Metal, Standard Duty: Thickness 0.050 inch, minimum.
- D. Edges: Beveled, on four sides unless otherwise indicated.
- E. Fasteners: Countersunk screw fasteners.
- F. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

## **2.12 KICK PLATES**

- A. Manufacturers:
  - 1. Basis of Design: Rockwood.
  - 2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Substitutions: Not permitted.
- B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
  - 1. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

## **2.13 WALL STOPS**

- A. Manufacturers:
  - 1. Basis of Design: Rockwood.
  - 2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Substitutions: Not permitted.
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
  - 1. Provide wall stops to prevent damage to wall surface upon opening door.
  - 2. Type: Bumper, concave, wall stop.
  - 3. Material: Brass housing with rubber insert.

## **2.14 THRESHOLDS**

- A. Manufacturers:
  - 1. Basis of Design: Pemko.
  - 2. Pemko; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Substitutions: Not permitted.
- B. Thresholds: Comply with BHMA A156.21.
  - 1. Provide threshold at interior doors for transition between two different floor types, and over building expansion joints, unless otherwise indicated.

2. Provide threshold at each exterior door, unless otherwise indicated.
3. Provide threshold with Sound Transmission Class (STC) of 25-30 at locations indicated.
4. Type: Flat surface.
5. Material: Aluminum.
6. Threshold Surface: Fluted horizontal grooves across full width.
7. Field cut threshold to profile of frame and width of door sill for tight fit.
8. Provide non-corroding fasteners at exterior locations.

## **2.15 WEATHERSTRIPPING AND GASKETING**

### **A. Rigid Seals:**

1. Manufacturers:
  - a. Pemko; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - b. Substitutions: Not permitted.
2. Weatherstripping and Gasketing: Comply with BHMA A156.22.
  - a. Head and Jamb Type: Adjustable.
  - b. Door Sweep Type: Encased in retainer.
  - c. Material: Aluminum, with brush weatherstripping.
  - d. Provide gasketing for smoke and draft control doors (Indicated as "S" on Drawings) that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
  - e. Provide frame-applied intumescent gasketing on wood doors that are labeled as smoke and draft control doors (Indicated as "S" on Drawings), unless otherwise indicated.
  - f. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
  - g. Provide door bottom sweep on each exterior door, unless otherwise indicated.
  - h. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

## **2.16 SILENCERS**

### **A. Manufacturers:**

1. Basis of Design: Rockwood.
2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
3. Substitutions: See Section 01 60 00 - Product Requirements.

### **B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.**

1. Single Door: Provide three on strike jamb of frame.
2. Pair of Doors: Provide two on head of frame, one for each door at latch side.

3. Material: Rubber, gray color.

## **2.17 KEY CONTROL SYSTEMS**

- A. Key Control Systems: Comply with guidelines of BHMA A156.28.
  1. Provide keying information in compliance with DHI (KSN) standards.
  2. Keying: Grand master keyed.
  3. Include construction keying and control keying with removable core cylinders.
    - a. Provide temporary keyed-alike cores.
    - b. Remove at substantial completion and install permanent cylinders/cores in Owner's presence.
      - 1) Demonstrate that construction key no longer operates.
  4. Key to existing keying system.
    - a. Factory registered master key system.
    - b. Restricted keyway, interchangeable core.
    - c. Contact Owner Locksmith with for keying requirements.
    - d. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers.
    - e. For estimate use factory GMK charge.
    - f. Furnish Owner's written approval of the system.
  5. Supply keys in following quantities:
    - a. 4 each Master keys.
    - b. 1 each Grand Master keys.
    - c. 1 each Great Grand Master keys.
    - d. 6 each Construction Master keys.
    - e. 15 each Construction keys.
    - f. 2 each Construction Control keys.
    - g. 2 each Control keys if new system.
    - h. 2 each Extra Cylinder cores.
    - i. 2 each Change keys for each keyed core.
  6. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
  7. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
  8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
  9. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
  10. Bitting List: Use secured shipment direct from point of origination to Owner upon completion.

11. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."

## **2.18 KEY CABINET**

- A. Manufacturers:
  1. Knox Company; Model 1300: [www.knoxbox.com](http://www.knoxbox.com).
  2. Lund Equipment: [www.lundkeycab.net](http://www.lundkeycab.net).
  3. MMF Industries: [www.mmfind.com](http://www.mmfind.com).
  4. Telkee: [www.telkee.com](http://www.telkee.com).
  5. Substitutions: Not permitted.
- B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
  1. Mounting: Wall-mounted.
  2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
  3. Size key hooks to hold 6 keys each.
  4. Finish: Baked enamel, manufacturer's standard color.
  5. Key cabinet lock to building keying system.

## **2.19 FIRE DEPARTMENT LOCK BOX**

- A. Manufacturers:
  1. Basis of Design: Knox Company.
  2. Knox Company; Knox-Box Rapid Entry System; Model 3227: [www.knoxbox.com](http://www.knoxbox.com).
  3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fire Department Lock Box: at Buildings or Site Walls
  1. Heavy-duty, recessed, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
  2. Capacity: Holds 10 keys.
  3. Finish: Manufacturer's standard dark bronze.
  4. Mounted to posts at manual gates (for driveways/roads) and as indicated on Drawings:
    - a. Key lock boxes shall be located at driver's side of gate entrance in a visible location as directed by Fire Department.
      - 1) Box shall be welded secure to metal posts. Box shall be 4 to 4-1/2 feet from top of box to finished grade.
    - b. Obtain approval from Fire Department of mounting location/position and operating standards before installation.
    - c. Products:
      - 1) Knox Company; Model 3208 or 3166, as applicable.
      - 2) Knox Decal 1001 shall be placed on gate.

- 3) Substitutions: See Section 01 60 00 - Product Requirements. Only if allowed or required by local Fire Department.
- C. Provide Knox Fire Department alert decals on all exterior doors of the facility and on all interior doors that keys have been furnished for within the lock box.
1. If the building/facility is protected with a fire alarm system or burglar alarm system, the lock boxes shall be "tamper" monitoring.
  2. The tamper monitoring must include the following:
    - a. All central stations shall be UL listed.
    - b. For combination Fire/Burglar Alarm Panels, the Knox Box monitoring shall be through the fire side of the panel.
    - c. Central stations upon receiving a Knox Box tamper alarm signal shall:
      - 1) Notify and respond to local Police Department (Knox Box tamper).
      - 2) Notify and respond to the local Fire Department (Knox Box tamper).

## **2.20 FINISHES**

- A. Finishes: Identified in Section 08 0671 - Door Hardware Schedule.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.
- C. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.
- D. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.

### **3.02 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
  1. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
  2. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
    - a. Gaskets:
      - 1) Install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals.
      - 2) Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

- b. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
  - c. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
  - d. Replace fasteners damaged by power-driven tools.
- 3. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- 4. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- 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.
  - 5. Glue in solid wood block fillers to fill cut outs in existing wood doors, sand surfaces smooth. Alternatively, use an approved epoxy-based wood filler product, submit product data for approval.
  - 6. 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.
  - 7. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.
- E. Use templates provided by hardware item manufacturer.
- F. Do not install surface mounted items until application of finishes to substrate are fully completed.
- G. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
  - 1. Comply with California Building Code, Section 1010.2.3, 11B-309.4 and 11B-404.2.7.
    - a. Refer also to CBC requirements noted in Part 1 of this section.
  - 2. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
  - 3. For Steel Doors and Frames: See Section 08 11 13.
  - 4. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.



5. Flush Wood Doors: See Section 08 14 16.
6. Mounting heights in compliance with ADA Standards and CBC Chapter 11B:
  - a. Locksets: 34 to 44 inches.
  - b. Push/Pulls: 34 to 44 inches.
  - c. Dead Locks: 44 inches.
  - d. Exit Devices: 36 (clear) to 44 inches.
  - e. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware when compliant with codes.
- H. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.
  1. See Section 07 92 00 for additional requirements.
- I. Locate floor stops no more than 4 inches (maximum outside dimension) from walls and not within paths of travel. See Article "Hinges" in Part 2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- J. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.
- B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

### **3.04 ADJUSTING**

- A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
  1. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
    - a. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
    - b. Adjust doors to fully latch with no more than 1 pound of pressure.
    - c. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
    - d. Adjust door closers per "Commissioning" article below.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.
- D. Fire-rated doors (NFPA 80):
  1. Wood Doors: Adjust to 1/8 inch clearance at heads, jambs, and meeting stiles.

2. Steel Doors: Adjust to 1/16 inch minimum to 3/16 inch maximum clearance at heads, jambs, and meeting stiles.
  3. Adjust wood and steel doors to 3/4 inch maximum clearance (undercut) above threshold or finish floor material under door.
- E. Inspection of fire door assemblies and means-of-egress panic-hardware doors:
1. Per NFPA 80 5.2.1:
    - a. Provide an independent third-party inspection service to prepare a report listing these doors, and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.
    - b. Certification, Testing and Quality Control shall be in accordance with Section 01 45 33 - Code-Required Special Inspections.
    - c. All doors hardware and installation will be inspected by a third party selected by the Architect/Owner.
- F. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
1. Has re-adjusted hardware.
  2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
  3. Has identified items that have deteriorated or failed.
  4. Has submitted written report identifying problems.

### **3.05 COMMISSIONING:**

- A. Conduct these tests prior to request for certificate of substantial completion:
1. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.
  2. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.
  3. Inspection of fire door assemblies and means-of-egress panic-hardware doors:
    - a. Contractor shall provide an independent third-party inspection service to prepare a report listing the proper operation and functionality of these doors.
    - b. Include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.
  4. With installer present, test door hardware operation for compliance with push and pull force requirements per ADA and CBC.

### **3.06 CLEANING**

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

- D. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

### **3.07 PROTECTION**

- A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

### **3.08 CLOSEOUT**

- A. Return of temporary cores for return/receipt by Contractor.
- B. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
  - 1. Has re-adjusted hardware.
  - 2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
  - 3. Has identified items that have deteriorated or failed.
  - 4. Has submitted written report identifying problems.

### **3.09 SCHEDULE OF FINISH HARDWARE**

- A. See door schedule in drawings for hardware set assignments.
- B. No hardware shall be ordered until Finish Hardware has been reviewed and approved by Architect's hardware consultant.
- C. Provide Factory order numbers for all products supplied on this project as part of close out documents for Owner's warranty records.
- D. See schedule in Section 08 06 71 - Door Hardware Schedule.

## **END OF SECTION**

## **SECTION 08 80 00 GLAZING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic films. GF-1 & GF-2
- D. Glazing compounds.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- D. Section 10 28 00 - Toilet Accessories: Mirrors.

#### **1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1036 - Standard Specification for Flat Glass.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- L. GANA (GM) - GANA Glazing Manual.
- M. GANA (SM) - GANA Sealant Manual.
- N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
- O. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

- P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 8 by 8 inch in size of glass units.
- E. Samples: Submit 4 inch long bead of glazing sealant, color as selected.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

#### **1.06 QUALITY ASSURANCE**

- A. Perform Work in accordance with GANA (GM), GANA (SM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

#### **1.07 FIELD CONDITIONS**

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

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

1. Remedial Provisions: Upon notification of defects, within the warranty period, party providing warranty or guarantee shall replace the glass and glazing at no cost to Owner.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with the all applicable codes and ordinances, including California Building Code (CBC), Title 24, Part 2, Chapter 24 as amended and adopted by authorities having jurisdiction, and US Consumer Product Safety Commission Standard 16 CFR 1201 CI and CII.
- B. Where safety glass is indicated or required, provide glazing materials that conform to ANSI Z97.1 and CPSC 16 CFR 1201 and are so identified in accordance with CBC Section 2406.3.
- C. Glass Identification:
  1. Per CBC Section 2403.1, each light shall bear the manufacturer's label designating the type and thickness of glass.
    - a. When approved by the enforcement agency, labels may be omitted from other than safety glazing materials, provided an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved plans and specifications.
    - b. Identification of safety glazing material installed in hazardous locations as defined in Section 2406 of this chapter shall be identified by label which will specify the labeler, whether the manufacturer or installer, and state that safety glazing material has been utilized in such installations.
    - c. The label shall be legible and visible from the inside of the building after installation and shall specify that label shall not be removed.
    - d. Tempered glass shall have an etched manufacturer's label.

### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  1. Design Pressure: Calculated in accordance with ASCE 7.
    - a. Where glass thicknesses are not indicated, provide thickness based on the wind pressures required by the California Building Code (CBC), Title 24, Part 2, 2403 and 2404, wind pressure shall be assumed to have a one minute duration.
    - b. Upon first application of design wind load for the specified durations, probability of breakage shall not exceed 8/1000 for vertical glass.
    - c. Probability of breakage relative to glass thermal stress shall not exceed 8/1000 for vertical glass.
  2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
  4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  5. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
  2. To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapor retarder and air barrier seal.
  3. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  3. Solar Optical Properties: Comply with NFRC 300 test method.

## **2.03 GLASS MATERIALS**

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
  2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
  3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
    - a. Where fully tempered is indicated, provide glass that has been tempered by the tong-less horizontal method.
  4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
  5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

## **2.04 INSULATING GLASS UNITS**

- A. Manufacturers:
1. Glass: Any of the manufacturers specified for float glass.
  2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

3. AGC Glass North America, Inc: [www.agcglass.com/#sle](http://www.agcglass.com/#sle).
  4. Cardinal Glass Industries: [www.cardinalcorp.com/#sle](http://www.cardinalcorp.com/#sle).
  5. Glasswerks: [glasswerks.com](http://glasswerks.com).
  6. Guardian Glass, LLC: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
  7. Pilkington North America Inc: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  8. Viracon, Apogee Enterprises, Inc: [www.viracon.com/#sle](http://www.viracon.com/#sle).
  9. Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  10. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  3. Metal Edge Spacers: Aluminum, bent and soldered corners.
  4. Spacer Color: Black.
  5. Edge Seal:
    - a. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.
    - b. Color: Black.
  6. Purge interpane space with dry air, hermetically sealed.
- C. Type GL-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
  2. Space between lites filled with air.
  3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Coating: Low-E (passive type), on #2 surface.
  4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
  5. Total Thickness: 1 inch.
- D. Type IG-5 - Insulating Glass Units: Safety glazing.
1. Applications:
    - a. Other locations required by applicable federal, state, and local codes and regulations.
  2. Space between lites filled with air.
  3. Glass Type: Same as Type GL-1 & GL-2 except use fully tempered float glass for both outboard and inboard lites.
  4. Total Thickness: 1 inch.



## **2.05 BASIS OF DESIGN - INSULATING GLASS UNITS**

- A. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.
  - 1. Applications: Exterior insulating glass glazing unless otherwise indicated.
  - 2. Space between lites filled with air.
  - 3. Total Thickness: 1 inch.
  - 4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
  - 5. Visible Light Transmittance (VLT): 64 percent, nominal.
  - 6. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.
  - 7. Visible Light Reflectance, Outside: 12 percent, nominal.
  - 8. Glazing Method: Dry glazing method, gasket glazing.
  - 9. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 10. Spacer Color: Black.
  - 11. Edge Seal:
  - 12. Color: Black.
  - 13. Purge interpane space with dry air, hermetically sealed.
- B. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 1. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
    - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 70 on #2 surface.
    - b. Glass: Clear.
  - 2. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
    - a. Glass: Clear.

## **2.06 GLAZING UNITS**

- A. Monolithic Interior Vision Glazing:
  - 1. Applications: Interior glazing unless otherwise indicated.
  - 2. Glass Type: Annealed float glass.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch, nominal.
  - 5. Glazing Method: Dry glazing method, gasket glazing.
- B. Monolithic Safety Glazing: Non-fire-rated.
  - 1. Applications:
    - a. Glazed lites in doors, except fire doors.
    - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
    - c. Glazed view windows and panels in partitions enclosing athletic activity rooms, except in fire-rated walls and partitions.

- d. Other locations required by applicable federal, state, and local codes and regulations.
  - e. Other locations indicated on drawings.
- 2. Glass Type: Fully tempered safety glass as specified.
- 3. Tint: Clear.
- 4. Thickness: 1/4 inch, nominal.
- 5. Glazing Method: Dry glazing method, gasket glazing.

## **2.07 PLASTIC FILMS**

- A. Type GF-1 & GF-2 - Decorative Plastic Film: Polyester type.
  - 1. Application: Locations as indicated on drawings.
  - 2. Series Type: Specialty.
  - 3. Color: As selected by Architect.
  - 4. Thickness Without Liner: 0.002 inch.
  - 5. Width: 48 inch.
  - 6. Manufacturers:
    - a. 3M Window Film; scotchcal translucent film series 3630: [www.3m.com/windowfilm](http://www.3m.com/windowfilm).
    - b. Flexvue Films: [www.flexvuefilms.com](http://www.flexvuefilms.com).
    - c. Llumar, an Eastman Chemical Company; Decorative Window Film, Llumar: [www.llumar.com/#sle](http://www.llumar.com/#sle).
    - d. Madico, Inc: [www.madico.com](http://www.madico.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.08 GLAZING COMPOUNDS**

- A. Type GC-3 - Polysulfide Sealant: Two component; chemical curing, nonsagging type; ASTM C920 Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

## **2.09 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

1. Width: As required for application.
2. Thickness: As required for application.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

### **3.06 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove nonpermanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.07 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

## **SECTION 08 91 00 LOUVERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Louvers, frames, and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 62 00 - Sheet Metal Flashing and Trim.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

#### **1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.
- D. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
- D. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior and interior surfaces.
- E. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Maintenance Data: Include lubrication schedules, adjustment requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

## **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
  - 1. Finish: Include twenty year coverage against degradation of exterior finish.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Louvers:
  - 1. Airolite Company, LLC: [www.airolite.com](http://www.airolite.com).
  - 2. Architectural Louvers, [www.archlouvers.com](http://www.archlouvers.com)
  - 3. Construction Specialties, Inc: [www.c-sgroup.com](http://www.c-sgroup.com).
  - 4. Nystrom: [www.nystrom.com](http://www.nystrom.com).
  - 5. Pottorff: [www.pottorff.com](http://www.pottorff.com).
  - 6. Ruskin Company; Stationary Louvers: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).

### **2.02 LOUVERS**

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
  - 1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.
  - 2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
  - 3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
  - 4. Maintenance Building Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Maintenance Building Stationary Louvers: Vertical blade, extruded aluminum construction.
  - 1. Maintenance Building Basis of Design Product: C/S 5 inch Deep, Vertical Aluminum Louver Model RS-5605 as manufactured by Construction Specialties, Inc, or equal.
  - 2. Free Area: 59 percent, minimum at 4 ft by 4 ft.
  - 3. Blades: V-shaped, sight-proof.
  - 4. Frame: 5 inches deep, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
  - 5. Aluminum Thickness: Frame ~14 gauge, 0.060 inch minimum; blades ~14 gauge, 0.060 inch minimum.

6. Aluminum Finish: High performance silicone-modified polyester (SMP) organic coatings; finish welded units after fabrication.
- C. Generator Enclosure Stationary Louvers: Horizontal blade, formed galvanized steel sheet construction.
  1. Generator Enclosure Basis of Design Product: C/S 6 inch Deep, Formed Galvanized Drainable Louver Model GS-607 as manufactured by Construction Specialties, Inc, or equal.
  2. Free Area: 53 percent, minimum.
  3. Blades: Drainable.
  4. Frame: 6 inches deep, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
  5. Steel Thickness, Galvanized: Frame 16 gauge, 0.0598 inch minimum base metal; blades 16 gauge, 0.0598 inch minimum base metal.
  6. Steel Finish: Superior performing organic coating, finished after fabrication.

### **2.03 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

### **2.04 FINISHES**

- A. High Performance Organic Coating: Primer and silicone-modified polyester (SMP) enamel topcoat with minimum dry film thickness (DFT) of 1.2 mils, 0.0012 inch over aluminum extrusions and panels; AAMA 2604.
- B. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
- C. Primer: Zinc chromate, alkyd type.
- D. Color: As selected from manufacturer's standard colors.

### **2.05 ACCESSORIES**

- A. Maintenance Building Exhaust Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, diagonal design.
- B. Maintenance Building Intake Insect Screen: 18 x 16 size aluminum mesh.
- C. Fasteners and Anchors: Stainless steel.
- D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
- E. Maintenance Building Head and Sill Flashings: See Section 07 62 00.
- F. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
- B. Verify that field measurements are as indicated.

### **3.02 INSTALLATION**

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Coordinate with installation of flashings by others.
- C. Install louvers level and plumb.
- D. Set sill members and sill flashing in continuous bead of sealant.
- E. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- F. Secure louver frames in openings with concealed fasteners.
- G. Coordinate with installation of mechanical ductwork.

### **3.03 ERECTION TOLERANCES:**

- A. Maximum variation from plane or location shown on the approved shop drawings: 1/8 inch per 12 feet of length, but not exceeding 1/2 inch in any total building length or portion thereof (non-cumulative).
- B. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3 inch: 1/16 inch (shop or field joints). This limiting condition shall prevail under both load and no load conditions.

### **3.04 CLEANING**

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

**END OF SECTION**



**SECTION 09 05 61**  
**COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Resilient tile and sheet.
    - a. Moisture vapor seal is required at all locations to receive resilient flooring regardless of moisture test.
  - 2. Broadloom carpet.
    - a. Sealer is not needed under Tandus Power Bond Carpet.
  - 3. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- F. Patching compound.
- G. Remedial floor coatings.
- H. Remedial floor treatment.
- I. Preparation of new and existing wood-based floors and subfloors for installation of new floor coverings.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 01 74 19 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.
- C. Section 03 30 00 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
- D. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

### **1.03 REFERENCE STANDARDS**

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens).
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete.
- C. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.
- D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- G. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Visual Observation Report: For existing floor coverings to be removed.
- C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
  - 1. Manufacturer's qualification statement.
  - 2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over remedial product.
  - 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
  - 4. Manufacturer's installation instructions.
  - 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- E. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.

5. Recommendations for remediation of unsatisfactory surfaces.
  6. Product data for recommended remedial coating.
  7. Certificate: Include certification of accuracy by authorized official of testing agency.
  8. Submit report to Architect.
  9. Submit report not more than two business days after conclusion of testing.
- F. Adhesive Bond and Compatibility Test Report.
- G. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.
- H. Copy of RFCI (RWP).

#### **1.06 QUALITY ASSURANCE**

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform additional adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
  2. Acceptable Testing Agencies:
    - a. Independent Floor Testing & Inspection, Inc. (IFTI): [www.ifti.com/#sle](http://www.ifti.com/#sle).
    - b. Other testing agency approved by Owner.
    - c. Substitutions: See Section 016000.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
  2. Confirm date of start of testing at least 10 days prior to actual start.
  3. Allow at least 4 business days on site for testing agency activities.
  4. Achieve and maintain specified ambient conditions.
  5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.
- F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

## **1.08 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  - 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
  - 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
  - 4. Products:
    - a. ARDEX Engineered Cements; ARDEX Feather Finish: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Floor Seal Technology, Inc; Color Match Patch: [www.floorseal.com/#sle](http://www.floorseal.com/#sle).
    - c. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - d. Mapei International; Mapei Ultraplan 1 Plus: [www.mapei.com](http://www.mapei.com).
    - e. Sika Corporation; Sika Level-315: [www.sikafloorusa.com](http://www.sikafloorusa.com).
    - f. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: [www.usg.com/#sle](http://www.usg.com/#sle).
    - g. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
  - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

2. Products:
  - a. ARDEX Engineered Cements; ARDEX MC RAPID: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - b. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - c. Floor Seal Technology, Inc; MES 100 with Floor Seal FloorCem SLU: [www.floorseal.com/#sle](http://www.floorseal.com/#sle).
  - d. Koster American Corporation; Koster VAP I 2000 with Koster SL Premium overlay: [www.kosterusa.com/#sle](http://www.kosterusa.com/#sle).
  - e. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - f. LATICRETE International, Inc; LATICRETE SUPERCAP Moisture Vapor Control with LATICRETE SUPERCAP Underlayment: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - g. Maxxon Corporation; Aquafin SG4: [www.maxxon.com/#sle](http://www.maxxon.com/#sle).
  - h. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: [www.sikafloorusa.com/#sle](http://www.sikafloorusa.com/#sle).
  - i. Tnemec Company, Inc; Series 208 Epoxoprime MVT: [www.tnemec.com/#sle](http://www.tnemec.com/#sle).
  - j. USG Corporation; Durock CoverPrep: [www.usg.com/#sle](http://www.usg.com/#sle).
  - k. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 CONCRETE SLAB PREPARATION**

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
  1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
    - a. Do not attempt to remove coating or penetrating material.
    - b. Do not abrade surface.
    - c. Remove existing coatings and curing agents from surface according to recommendations of remedial coating manufacturer.
    - d. Prepare surface according to recommendations of remedial coating manufacturer and according to ASTM D4259.
  3. Preliminary cleaning.
  4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.

5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  7. Specified remediation, if required.
  8. Patching, smoothing, and leveling, as required.
  9. Other preparation specified.
  10. Adhesive bond and compatibility test.
  11. Protection.
- C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
  2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
  3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

### **3.02 REMOVAL OF EXISTING FLOOR COVERINGS**

- A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

### **3.03 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

### **3.04 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

### **3.05 INTERNAL RELATIVE HUMIDITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

### **3.06 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
  - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
  - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
  - 3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

### **3.07 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with recommendations of testing agency.
- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

- E. Do not fill expansion joints, isolation joints, or other moving joints.

### **3.08 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

### **3.09 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.
- B. Install remedial coating over all concrete floor areas where moisture emission and/or alkalinity exceeds the floor covering manufacturer's published limits.
- C. Prepare floor areas to be coated in accordance with coating manufacturer's requirements.
  - 1. Mask and protect adjacent wall and floor surfaces from damage due to this work.
- D. Apply coating using manufacturer's recommended procedures.
- E. Apply 1/8 inch thick cementitious surfacing over coating in areas to receive adhesively applied floor coverings.
- F. Verify that prepared floor slab has moisture emission rate and alkalinity meeting requirements.

### **3.10 APPLICATION OF REMEDIAL FLOOR TREATMENT**

- A. Comply with requirements and recommendations of treatment manufacturer.

### **3.11 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION**



## **SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.
- C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- D. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

#### **1.03 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data.
- C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.
- D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.
- E. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.
- F. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- G. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- H. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- I. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- J. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

- L. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- M. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
- N. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
- O. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- P. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- Q. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- R. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- S. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- T. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- U. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- V. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- W. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- X. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.
- Y. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- Z. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- AA. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- BB. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- CC. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- DD. ASTM E413 - Classification for Rating Sound Insulation.
- EE. CBC - California Building Code.
- FF. GA-216 - Application and Finishing of Gypsum Panel Products.
- GG. GA-600 - Fire Resistance and Sound Control Design Manual.
- HH. UL (FRD) - Fire Resistance Directory.
- II. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Install service utilities in an orderly and expeditious manner.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
  - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
  - 3. Joint Treatment Materials: Submit manufacturer's product data, indicating VOC content.
- C. Application Procedures: Submit a general written description of procedures to be followed where fire-rated work is being done and where alternative assemblies are proposed.
- D. Evaluation Service Reports: Show compliance of grid suspension systems with specified requirements.
- E. Product Certifications:
  - 1. Studs and Tracks: Provide third party documentation that framing members' meet AISI S220 and CBC tolerance requirements including base steel thickness, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
    - a. Certification by the Steel Framing Industry Association (SFIA) program, "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members", meets these requirements.
  - 2. Anchoring Clips: Provide third party documentation that vertical deflection clips and drift clips meet CBC requirements and stated design performance.
    - a. Certification by the Steel Framing Industry Association (SFIA), "Cold-Formed Connector Program", meets these requirements.
- F. SSFSA Manufacturer Qualification: Submit documentation of manufacturer association membership.  
OR
- G. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.
- H. Installer's Qualification Statement.
  - 1. Including contractor's recognition in the SFIA "Contractor Certification Program".
- I. Provide letter from manufacturer that upper and lower track system to be utilized will maintain sound and fire rating of specified assembly.

## **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Member of the Steel Framing Industry Association (SFIA) in compliance with the SFIA "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members".
- B. Regulatory Requirements: Conform to California Building Code (CBC), Title 24, Part 2, Chapter 7, Chapter 8, and Chapter 25, as amended and adopted by authorities having jurisdiction.
- C. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- C. Store metal products to prevent corrosion.

## **1.08 DELIVERY, STORAGE AND HANDLING**

- A. Deliver gypsum board and accessories in manufacturer's original unopened containers, bundles or rolls bearing manufacturer's identification.
- B. Store materials inside the building or in other dry weather tight enclosure. Stack gypsum board flat and off the floor. Do not stack long lengths over shorter lengths.
- C. Store flammable adhesives away from fire, sparks and smoking areas.
- D. Handle gypsum board to prevent damage to edges, ends, and surfaces.
- E. Protect cold-formed metal framing from corrosion deformation, and other damage during delivery, storage and handling as required by AISI's "Code of Standard Practice."

## **PART 2 PRODUCTS**

### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
  - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions in accordance with ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
  - 1. Local authorities having jurisdiction.
- D. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:

1. Fire-Resistance-Rated Partitions: UL listed assembly No. Non-Bearing U465; 1 hour rating.
2. Fire-Resistance-Rated Partitions: UL listed assembly No. Non-Bearing U419; 1 through 4 hour rating.
3. Fire-Resistance-Rated Shaft Walls: UL listed assembly No. U415; 1 and 2 hour rating.
4. CBC Chapter 7 Item Numbers: Comply with applicable requirements of CBC Chapter 7 Tables for the particular assembly; as indicated on Drawings.
5. Gypsum Association Generic File Numbers: Comply with requirements of GA-600 for the particular assembly; as indicated on Drawings.
6. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD); as indicated on Drawings.

## **2.02 METAL FRAMING MATERIALS**

- A. Material and Product Requirements Criteria: AISI S201.
- B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
  1. Structural Grade: As required to meet design criteria.
  2. Corrosion Protection Coating Designation: G60, or equivalent in accordance with AISI S220.
- C. Manufacturers - Metal Framing, Connectors, and Accessories:
  1. Cemco: [www.cemcosteel.com](http://www.cemcosteel.com).
    - a. ICC ESR-2012 and ICC ESR-2016.
    - b. Viper-x Studs: IAPMO ER-0524, ICC ESR-2620.
  2. ClarkDietrich Building Systems: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
    - a. ICC ESR-1166P and Intertek CCRR-0205.
  3. Frametek Steel: [www.frameteksteel.com](http://www.frameteksteel.com).
    - a. ICC ESR 4205.
  4. Marino: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
    - a. Viper-x Stud: IAPMO ER-0524, ICC ESR-2620.
    - b. ICC ESR-4062.
  5. Steel Framing Industry Association (SFIA) member in compliance with SFIA Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Members.
  6. a. ICC ESR-4205.
  7. Steel Stud Manufacturers Association [www.ssma.com](http://www.ssma.com).
    - a. ICC ESR-3064P.
  8. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Structural Steel Framing for Application of Gypsum Board: See Section 05 40 00.

- E. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing as recommended by cladding manufacturer of L/240 at 5 psf for gypsum board and L/360 at 5 psf for tiling.
  - 1. Studs: C-shaped with knurled or embossed faces.
  - 2. Paired Studs for Sound-Rated Assemblies: Engineered single-piece assemblies comprised of paired studs coupled by sound isolators, designed to replace conventional side-by-side, parallel, double-wall partition framing.
    - a. Widths: As indicated on drawings.
  - 3. Runners: U shaped, sized to match studs.
  - 4. Headers: As detailed on Drawings or ProX Header per IAPMO ER-2086.
  - 5. Ceiling Channels: C-shaped.
  - 6. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
- F. Notched Metal Stud/Channel Backing and Sheet Metal Backing: 54 mil (0.0538 inch) thick, galvanized for attachment and support of products to be attached to framing..
  - 1. As indicated on Drawings.
  - 2. Notched 16 gage (54-mil) stud covering full width of two stud spacing by 36 inch wide minimum.
  - 3. Optional: 6 by 1-1/4 inch by 16 gage flush mount backing with pre-punched screw holes, FLUSH-MOUNT Backing by Metal-Lite Inc., [www.metal-lite.net](http://www.metal-lite.net) or approved equivalent.
- G. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
  - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100 and AISI S220.
  - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
  - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
  - 4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance and sound rating of the wall assembly.
    - a. Products:
      - 1) ClarkDietrich; BlazeFrame RipTrak: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
      - 2) FireTrak Corporation; Posi Klip: [www.fire-trak.com/#sle](http://www.fire-trak.com/#sle).
      - 3) Metal-Lite, Inc; The System: [www.metal-lite.net/#sle](http://www.metal-lite.net/#sle).
      - 4) Super Stud Building Products, Inc; Slotted Deflection Track: [www.buysuperstud.com/#sle](http://www.buysuperstud.com/#sle).
      - 5) SFIA member in compliance with Code Certification Program.
      - 6) Substitutions: See Section 01 60 00 - Product Requirements.

- H. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
1. Products:
    - a. BlazeFrame: "BlazeFrame"; [www.blazeframe.com](http://www.blazeframe.com). UL 2079
    - b. CEMCO: FAS Track; [www.cemcosteel.com](http://www.cemcosteel.com), ICC-ES ESR-2012.
    - c. ClarkDietrich; BlazeFrame Firestop Deflection Track: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle). UL 2079.
    - d. Rectorseal, Inc.; Track-Safe: [www.biofireshield.com](http://www.biofireshield.com).
    - e. Ware Industries, Inc. (dba Marinoware): ViperTrack; [www.marinoware.com](http://www.marinoware.com), ICC-ES ESR-2620.
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Preformed Top Track Firestop Seal:
1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
  2. Products:
    - a. CEMCO: HOT ROD Type X and XL; [www.cemcosteel.com](http://www.cemcosteel.com), ICC-ES ESR-2012.
    - b. Hilti, Inc; Top Track Seal CFS TTS: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - c. Ware Industries, Inc. (dba Marinoware): HOT ROD Type X and XL; [www.marinoware.com](http://www.marinoware.com), ICC-ES ESR-2620.
    - d. Specified Technologies Inc; SpeedFlex TTG Track Top Gasket: [www.stfirestop.com/#sle](http://www.stfirestop.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- J. Non-structural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
  2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
    - a. Provide a premanufactured wall brace compliant with CBC Section 1607A.15.
    - b. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
    - c. Height: 35-3/4 inches.
    - d. Products:
      - 1) ClarkDietrich; Pony Wall (PW): [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
      - 2) The Steel Network, Inc.; MidWall; [www.steelnetwork.com](http://www.steelnetwork.com).
      - 3) Simpson Strong-Tie Co.; RCKW Knee Wall Connector: [www.strongtie.com](http://www.strongtie.com).
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.
    - e. Alternate Method Partial-Height Wall Brace: Provide steel post as indicated on Drawings.
  3. Framing Connectors: ASTM A653/A653M G60 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

- K. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
  - 1. Products:
    - a. USG Corporation; Drywall Suspension System: [www.usg.com/#sle](http://www.usg.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 BOARD MATERIALS**

- A. General: Gypsum board, joint treatment and finishing materials shall be manufactured from asbestos-free materials.
- B. Manufacturers - Gypsum-Based Board:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - 3. National Gypsum Company: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  - 4. PABCO Gypsum: [www.pabco gypsum.com/#sle](http://www.pabco gypsum.com/#sle).
  - 5. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
    - b. Mold resistant board is required at all locations.
  - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 4. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
    - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  - 5. Mold-Resistant, Paper-Faced Products:
    - a. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
    - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - e. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).



- f. PABCO Gypsum; MOLD CURB® PLUS Regular Mold and Moisture- Resistant Gypsum Board: [www.pabco gypsum.com/#sle](http://www.pabco gypsum.com/#sle).
  - g. PABCO Gypsum; MOLD CURB® PLUS Type X Mold and Moisture- Resistant Gypsum Board: [www.pabco gypsum.com/#sle](http://www.pabco gypsum.com/#sle).
  - h. USG Corporation; Sheetrock Brand EcoSmart Panels Mold Tough Firecode X 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
  - i. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
  - j. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Abuse Resistant Wallboard:
- 1. Application: High-traffic areas indicated.
    - a. Corridors.
    - b. Restrooms.
    - c. Storage Rooms.
    - d. Areas as indicated on Drawings.
    - e. Provide up to 96 inches, minimum.
  - 2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  - 3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
  - 4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
  - 5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
  - 7. Type: Fire-resistance-rated Type X, UL or WH listed.
  - 8. Thickness: 5/8 inch.
  - 9. Edges: Tapered.
  - 10. Paper-Faced Products:
    - a. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Abuse Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - d. USG Corporation; Fiberock Brand AR Interior Panels FRX-G 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
    - e. USG Corporation; Sheetrock Brand AR Firecode X Panels 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
    - f. PABCO Gypsum; ABUSE CURB® Type X Gypsum Board: [www.pabco gypsum.com/#sle](http://www.pabco gypsum.com/#sle).

- g. USG Corporation; Sheetrock Brand Mold Tough AR Firecode X 5/8 in. (15.9 mm):  
[www.usg.com/#sle](http://www.usg.com/#sle).
  - h. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Backing Board For Wet Areas:
  - 1. Application: Surfaces behind tile in wet areas including locations where noted.
  - 2. Application: Horizontal surfaces behind tile in wet areas including countertops.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 4. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    - a. Thickness: 1/2 inch.
    - b. Products:
      - 1) Custom Building Products; Wonderboard:  
[www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
      - 2) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
      - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- F. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
  - 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 4. Type X Thickness: 5/8 inch.
  - 5. Regular Board Thickness: 5/8 inch.
  - 6. Edges: Tapered.
  - 7. Products:
    - a. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
    - b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board:  
[www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - c. Lafarge North America Inc; Mold Defense Drywall.
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
  - 1. Application: Exterior sheathing, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Core Type: Regular and Type X, as indicated.
5. Type X Thickness: 5/8 inch.
6. Regular Board Thickness: 5/8 inch.
7. Edges: Square, for vertical application or horizontal.
8. Glass Mat Faced Products:
  - a. CertainTeed Corporation; GlasRoc Brand.
  - b. Georgia-Pacific Gypsum; DensGlass Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - c. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
  - e. USG Corporation: Securock Brand Glass Mat Sheathing.
  - f. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.04 GYPSUM BOARD ACCESSORIES**

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: Fill the stud wall cavity.
  1. Application:
    - a. Partitions with STC Rating:
      - 1) Insulation fill at gypsum board partition stud framing.
      - 2) Surround penetrations in gypsum board partitions.
    - b. Gypsum board ceilings adjacent to sound-rated partitions.
  2. Surface Burning Characteristics as per ASTM E84: Flame Spread of 10; Smoke Developed of 10.
  3. Products:
    - a. Owens-Corning; Sound Attenuation Batts: [www.owenscorning.com](http://www.owenscorning.com).
    - b. CertainTeed; "NoiseReducer" Sound Attenuation Batts: [www.certainteed.com](http://www.certainteed.com).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Sealants: For penetrations at fire-rated construction, provide firestopping as specified in Section 07 84 00 - Firestopping.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  1. Non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
  2. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following acoustical sealants for concealed joints:
    - a. Products:

- 1) Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant: [www.titebond.com/#sle](http://www.titebond.com/#sle).
  - 2) Liquid Nails, a brand of PPG Architectural Coatings: [www.liquidnails.com/#sle](http://www.liquidnails.com/#sle).
  - 3) Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
  - 4) Pecora Corp.; BA-98.
  - 5) Specified Technologies Inc; Smoke N Sound Acoustical Sealant: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
  - 6) Tremco, Inc.; Tremco Acoustical Sealant.
  - 7) USG Corporation; USG Sheetrock Acoustical Sealant
  - 8) Substitutions: See Section 01 60 00 - Product Requirements.
- D. Acoustic Foam Tape: 2 inch wide by 1/4 inch thick neoprene foam gasket/sealing tape.
1. SCE-41 Grade Neoprene sponge with a rubber based adhesive one side.
  2. Adhesive to utilize a white Kraft paper liner.
- E. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Manufacturers - Finishing Accessories:
    - a. Flannery, Inc.: [flannerytrim.com](http://flannerytrim.com).
    - b. Fry Reglet: [fryreglet.com](http://fryreglet.com).
    - c. Phillips Manufacturing Co: [www.phillipsmfg.com](http://www.phillipsmfg.com).
    - d. Pittcon Industries: [www.pittconinsutries.com](http://www.pittconinsutries.com)
    - e. Trim-tex, Inc.: [www.trim-tex.com](http://www.trim-tex.com).
    - f. CEMCO Products, Inc; [www.cemco.com](http://www.cemco.com).
    - g. USG Corporation: [www.usg.com](http://www.usg.com)
    - h. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Corner Beads: Low profile, for 90 degree outside corners.
    - a. Cornerbead: USG Sheetrock B1 XW EL, or equal.
    - b. L Trim: USG Paper-faced "L" trim, B4 or equal.
  3. Architectural Reveal Beads:
    - a. Shapes: As indicated on drawings.
    - b. Basis of Design Manufacturer: Fry Reglet: [fryreglet.com](http://fryreglet.com).
      - 1) Reveal molding: Molding to create a vertical or horizontal recessed reveal.
        - (a) Acceptable product: Number DRM.
      - 2) "F" reveal molding: Trim reveal molding forming wall trim reveal where drywall terminates against sill, jamb, ceiling or other finish material in same plane.
        - (a) Acceptable product: Number DRMF.
        - (b) Dimensions: As indicated on drawings.
        - (c) Radius: As indicated on drawings.
    - c. Materials and Finish:

- 1) Interior Aluminum Surfaces: Extruded; Clear medium etched.
  - (a) Architectural 200R1 medium etch: AAMA 611 AA-M32C10A21 Clear color.
  - (b) Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.
- F. Ceiling Pockets with Prewired Raceway: UL 325 listed, extruded aluminum shade pocket with removable closure panel and ceiling tile support, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
  1. Designed to accommodate installation of motor control and wiring accessories within pocket.
- G. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
  2. Joint Compound: Drying type, vinyl-based, ready-mixed.
  3. Joint Compound: Setting type, field-mixed.
- H. Abuse Resistant Finishes:
  1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.
- I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- K. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- L. Adhesives
  1. Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene.
    - a. Adhesive shall contain a maximum VOC content of 50 grams per liter.
    - b. Adhesive must meet the requirements of low emitting materials credit.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.
- B. Beginning of installation means acceptance of substrate.
- C. Coordinate gypsum board Work with Work specified in other Sections to properly locate framing members and to provide additional framing and backing as necessary for recessed and built-in components.
  1. Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board.
  2. Maintain a minimum temperature of 50 degrees F for a period extending from 48 hours before installation until the joint compounds have completely dried.

- D. Examine substrates which gypsum board wall or shaft wall construction attaches to or abuts, including the following.
  - 1. Preset hollow metal frames
  - 2. Elevator hoistway door frames
  - 3. Piping.
  - 4. Conduit.
  - 5. Ductwork.
- E. Provide adequate and continuous ventilation to ensure proper drying, setting or curing of taping and finishing compounds. Provide temporary air circulators in enclosed areas lacking natural ventilation. GA-216, article 18.2.
- F. Provide fixtures, anchors, sleeves, inserts and miscellaneous items, and provide openings and chases as necessary. Prior to closing in and finishing of drywall Work, ascertain that piping, conduit, ductwork and fixtures which are to be concealed and which penetrate gypsum boards are in place, tested and approved.
- G. Scaffolding: Construct, erect and maintain in conformance with applicable laws and ordinances.
- H. Fire Protection: Where required, the Work shall comply with the requirements for the protection rating indicated in the governing building code.
- I. Fire Sprinkler System: In areas where sprinkler heads occur, exercise care when installing drywall work. Do not damage or obstruct the heads in any way.

### **3.02 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
  - 1. Level ceiling system to a tolerance of 1/1200.
  - 2. Laterally brace entire suspension system.
  - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
  - 1. Extend partition framing to structure in all locations.
  - 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
  - 3. Where screw attached wallboard is on one side only or extends to the floor above with no screw attached material on either side, brace unbraced flanges at 4 feet on center vertically.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
  - 1. Orientation: Vertical.
  - 2. Spacing: As indicated.
- F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install wood blocking (backing) for support of:
  - 1. Framed openings.
  - 2. Wall-mounted cabinets.
  - 3. Plumbing fixtures.
  - 4. Toilet partitions.
  - 5. Toilet accessories.
  - 6. Wall-mounted door hardware.
  - 7. Wall mounted equipment
  - 8. Wall mounted handrails
  - 9. Other locations, where indicated.
  - 10. Where sheet steel blocking(backing) is used on a wall with level 5 surface finish, provide shims between stud face and gypsum board panel to maintain a visually smooth level surface.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.
- C. Acoustic Tape: Place on top of all partition walls that do not project above suspended ceiling assemblies. Adhesive side shall be place on top of the wall.

### **3.04 BOARD INSTALLATION**

- A. Regulatory Requirements: Install gypsum board products in accordance with applicable Code requirements and requirements of listed assemblies shown on Drawings.
- B. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- C. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

1. Exception: Tapered edges to receive joint treatment at right angles to framing.
  2. In wood frame construction, erect panels horizontally only.
- D. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- E. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
1. Single Layer: Install and fasten gypsum board in accordance with CBC Title 24, Part 2, Table 721.1(2) for steel or wood construction. Install gypsum board vertically, with edges and ends occurring over firm bearing.
  2. Double Layer: Install and fasten gypsum board in accordance with CBC Title 24, Part 2, Table 721.1(2). Install base layer horizontally with ends occurring over firm bearing. Install face layer vertically with ends and edges occurring over firm bearing. Stagger joints 24 inches each side and opposite sides. Attach with required screws.
- F. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- G. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
1. Seal joints, cut edges, and holes with water-resistant sealant.
- H. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- I. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
- J. Fastener Spacing: Space fasteners in accordance with reference standards and fire rating requirements of wall, partition, floor and ceiling assembly. Maximum spacing of 1-inch screws 8 inches on centers at vertical edges and 12 inches on centers in field and at top and bottom.

### **3.05 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Use longest practical lengths. Place corner beads at external corners. Place edge trim when gypsum board abuts dissimilar materials. Surfaces indicated to receive non-textured finish and semi-gloss enamels.
- B. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
1. Not more than 30 feet apart on walls and ceilings.
  2. Maintain fire and sound rating at control joints.
- C. Corner Beads: Install at external corners, using longest practical lengths.
- D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### **3.06 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.



- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive, eggshell, semi-gloss or gloss paint finish and other areas specifically indicated. (Including High-Gloss thin wallcovering.)
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 3: Walls to receive textured wall finish or heavy textured paint.
  - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 6. Level 0: Temporary partitions.
- D. Tape, fill, and sand all exposed joints, edges, and corners, including inside corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
  - 2. Tape shall be set over joint and seated into joint compound, leaving sufficient adhesive under tape to provide proper bond.
  - 3. Internal angles, both horizontal and vertical, shall be reinforced and with tape folded to form straight and true angle.
  - 4. Metal external corners shall be cemented in place.
  - 5. Joints shall be allowed to dry according to Gypsum Association Standards based on temperature and humidity. Allow for at least 24 hours between each application of joint compound.
  - 6. The final application of compound and sanding shall leave all surfaces uniformly smooth and in condition to receive specified finish.
  - 7. Taping, filling, and sanding are not required at surfaces behind adhesive applied tile and fixed cabinetry.
  - 8. Taping, filling, and sanding are not required at base layer of double-layer applications.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.07 TOLERANCES**

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

### **3.08 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

### **3.09 PROTECTION**

- A. Protect installed gypsum board assemblies from subsequent construction operations.

### **3.10 REPAIR, CLEAN-UP AND PROTECTION**

- A. Repair damage to galvanized coatings in conformance with ASTM A780/A780M.
- B. Repair fastener pops by driving a new fastener approximately 1-1/2 inches from the fastener pop and reset the popped fastener. When face paper is punctured, install a new fastener approximately 1-1/2 inches from the defective fastener. Fill damaged surfaces with compound.
- C. Upon completion of the work, remove from adjacent surfaces, overspray, splatter and daubs of taping and finish compound and textured finishes. Remove tools, equipment, unused material and cuttings and leave the work in a clean orderly manner.

**END OF SECTION**

## **SECTION 09 22 36**

### **LATH**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Metal lath for cement plaster.
- B. Furring for metal lath.
- C. Metal ceiling framing.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Water-resistive barrier under exterior plaster and stucco.
- B. Section 08 31 00 - Access Doors and Panels: Product requirements for metal access panels integral with metal lath.
- C. Section 09 21 16 - Gypsum Board Assemblies: Sheathing on exterior walls.
- D. Section 09 24 00 - Cement Plastering.

##### **1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- D. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring.
- E. ASTM C847 - Standard Specification for Metal Lath.
- F. ASTM C933 - Standard Specification for Welded Wire Lath.
- G. ASTM C1032 - Standard Specification for Woven Wire Plaster Base.
- H. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
- I. CBC Sections 2504, 2507, and 2510.
- J. Plaster Assemblies Manual - Technical Information Services Bureau (TSIB) of Western Walls & Ceilings Contractors Association (WWCCA); Current Edition.

##### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

### **1.05 QUALITY ASSURANCE**

- A. Maintain one copy of each installation standard referenced on site throughout the duration of lathing and plastering work.
- B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Metal Lath and Accessories:
  - 1. Brand X Metals: [www.brandxmetals.com](http://www.brandxmetals.com).
  - 2. CEMCO: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
  - 3. ClarkDietrich: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 4. Stockton Products: [www.stocktonproducts.com](http://www.stocktonproducts.com).
  - 5. Structa Wire Corporation; Structalath: [www.structawire.com/#sle](http://www.structawire.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 FRAMING AND LATH ASSEMBLIES**

- A. Provide completed assemblies with the following characteristics: See also CBC Table 1604A.3.
  - 1. Maximum Deflection of Vertical Assemblies: 1:360 under lateral point load of 100 lbs.
  - 2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.

### **2.03 FRAMING MATERIALS**

- A. Furring Channels: Formed steel, minimum 0.020 inch thick, 3/8 inch deep by 7/8 inch high, splicing permitted; galvanized.
- B. Main Ceiling Channels: Formed steel, asphalt coated, minimum 0.05 inch thick, 3/4 inch deep by 1-1/2 inch high, single piece, no splicing; galvanized.
- C. Hangers: Steel wire, of size and type to suit application, to support ceiling components in place to deflection limits as indicated.
- D. Ceiling Hangers: Rolled steel sections, of size and type to suit application, to rigidly support ceiling components in place to deflection limits as indicated; galvanized.
- E. Lateral Bracing: Formed steel, minimum 0.060 inch thick, size and length as required; galvanized.

### **2.04 LATH**

- A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
  - 1. Weight: To suit application comply with deflection criteria and as specified in ASTM C841 or ASTM C1063 for framing spacing.
  - 2. Minimum Weight: 3.4 lb/sq yd.
- B. Ribbed Metal Lath: ASTM C847, galvanized; 3/8 inch thick. For soffit use only.

1. Weight: To suit application, comply with deflection criteria, and as specified in ASTM C841 or ASTM C1063 for framing spacing.
2. Minimum Weight: 3.4 lb/sq yd.
- C. Welded Wire Lath: ASTM C933; galvanized; with 2 inch square openings, paper strips woven into lath, of weight to suit application, comply with deflection criteria, and as specified in ASTM C841 or ASTM C1063 for framing spacing.
- D. Finishing Accessories: ASTM C841 (gypsum plaster) or ASTM C1063 (cement plaster); extruded aluminum alloy (6063 T5), galvanized steel sheet ASTM A924/A924M G90, or galvanized steel wire, unless noted otherwise.
  1. Types: As detailed or required for finished appearance.
  2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed plaster edges.
  3. Products:
    - a. Same manufacturer as framing materials.
    - b. Fry Reglet; Trim and Reveal Systems: [www.fryreglet.com](http://www.fryreglet.com).
    - c. Pittcon Industries: [www.pittconindustries.com](http://www.pittconindustries.com).
    - d. Stockton Products; Extruded Aluminum: [www.stocktonproducts.com/#sle](http://www.stocktonproducts.com/#sle).
    - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- E. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.
  1. Galvanized Steel Accessories:
    - a. Types specified below conforming to Technical Services Information Bureau of the Western Walls and Ceilings Contractors Association (WWCCA) "Plaster Assemblies Manual".
    - b. Where galvanized accessories are specified, use hot-dip galvanized steel, ASTM A653/A653M, designation G90/Z275, and bonderized.
    - c. Provide metal shapes, of longest possible length, used as grounds of such size and dimension as to provide for required plaster thickness.
  2. Material: Formed galvanized sheet steel, expanded metal flanges.
  3. Casing Beads with Weep Holes: Square edges.
    - a. Fabricated of 26 gauge, 0.0217 inch hot-dip galvanized steel and bonderized. Provide beads with expanded metal flange and inverted vee at plaster edge of face flange.
    - b. Provide weep holes only where indicated on drawings and in weeping conditions.
    - c. Products:
      - 1) CEMCO: #66 Expanded Flange Casing Bead: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
      - 2) Phillips Manufacturing Co; #66 Expanded Flange Square Casing Bead: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
      - 3) Stockton Products; JB: J-Bead: [www.stocktonproducts.com](http://www.stocktonproducts.com).
      - 4) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

4. Corner Beads: Square-Edge corners.
  - a. Corner Reinforcement: Fabricated from expanded metal with large openings, from welded or woven copper bearing steel wire of minimum 28 gage, hot-dip galvanized, minimum 3 inches wide.
  - b. Products:
    - 1) CEMCO; No. 2-A Corner Bead and ; No. 2-A Reinforced Flange Corner Bead: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
    - 2) Phillips Manufacturing Co; #1 Expanded Corner Bead: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
    - 3) Stockton Products: [www.stocktonproducts.com/#sle](http://www.stocktonproducts.com/#sle).
    - 4) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
5. Corner Reinforcement: Fabricated from from welded or woven copper bearing steel wire of minimum 28 gage, hot-dip galvanized, minimum 3 inches wide.
  - a. Products:
    - 1) CEMCO; Cemcorner: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
    - 2) Stockton Products: [www.stocktonproducts.com/#sle](http://www.stocktonproducts.com/#sle).
    - 3) Substitutions: See Section 01 60 00 - Product Requirements.
6. Corner Reinforcement: Fabricated from expanded metal with large openings, from welded or woven copper bearing steel wire of minimum 28 gage, hot-dip galvanized, minimum 3 inches wide.
  - a. Cornerite: Expanded Metal, weighing 0.105 pounds per lineal foot, bent in center to form 105 degree angle, 6 inches wide (total).
    - 1) Product: Cornerite manufactured by Cemco.
7. Expansion Joints: Accordion profile with factory-installed protective tape, 2 inch wide flanges.
  - a. Basis of Design Product: Double "J" Control Joint (#XJ-15) manufactured by CEMCO.
  - b. Basis of Design Product at Horizontal Conditions: M-Slide Expansion Joint manufactured by CEMCO.
  - c. Stress Relief Joints (Expansion and Control Joints): Stress Relief Control Joints, fabricated of 28 gage (0.0187 inch) hot-dip galvanized steel.
  - d. Interior Corner Expansion Joints: 26 gage (0.0217 inch) hot-dip galvanized steel. Double V expansion joint formed to 90 degrees.
    - 1) Products:
      - (a) CEMCO; Corner Expansion Joint (#30): [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
      - (b) Phillips Manufacturing Co; #15 Double V Expansion Joint: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
      - (c) Stockton Products: [www.stocktonproducts.com/#sle](http://www.stocktonproducts.com/#sle).
      - (d) Substitutions: See Section 01 60 00 - Product Requirements.
8. Base Screeds:

- a. Material: Galvanized steel, ASTM A653/A653M, with G90/Z275 zinc coating; minimum 26-gauge, 0.0179-inch thick base metal.
- b. Foundation Weep Screeds: Perforated type.
- c. Products:
  - 1) Basis of Design Product: NFD: #5 Drip, with weep holes manufactured by Stockton Products.
  - 2) Basis of Design Product: No. 7 Extended Foundation Screed manufactured by CEMCO. For locations where plaster is just above a paving surface.
  - 3) Stockton Products: [www.stocktonproducts.com/#sle](http://www.stocktonproducts.com/#sle).
  - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- 9. Drip Screeds: Fabricated from 0.018 inch thick; G-90 hot-dip galvanized steel.
  - a. Product: NFD: #5 Drip manufactured by Stockton Products.
  - b. Product: #6 Head Drip Screed manufactured by CEMCO. For locations above other flashing such as door and window heads.
- 10. Window/Door Drips: Self weeping 26 gage hot-dip galvanized steel.
  - a. Product: No. 3 Flashing Screed manufactured by CEMCO. For locations where plaster is offset 1-1/2 inches back from projection.
- 11. Strip Lath: Strip Reinforcement (Expanded Metal), weighing 2.5 lbs/sq.yd., 6 inches wide. Use hot-dip galvanized at all locations where galvanized metal lath occurs.
- 12. Control Joints: Accordion profile with factory-installed protective tape, 2 inch flanges.
  - a. Product: Double "V" Control Joint (#15) manufactured by CEMCO.
  - b. Stress Relief Joints (Expansion and Control Joints): Stress Relief Control Joints, fabricated of 26 gage (0.0217 inch) hot-dip galvanized steel with G60 hot-dip galvanized coating.
    - 1) Recesses on control joints shall be covered with removable tape or filled with rope to prevent plaster from filling the recess.

## 2.05 ACCESSORIES

- A. Access Panels: See Section 08 31 00.
- B. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized per ASTM C1063.
  - 1. Maximum Fastener Spacing for Lath: \_\_\_\_\_ inches O.C. per ASTM C1063.
  - 2. At Vertical Surfaces:
    - a. Furring Nails: With 1/4 inch wad attached, 1-1/2 inch long, 11 gage electrogalvanized, 7/16-inch head, barbed.
    - b. Staples (for wood): 16 wire gage, 3/4 inch crown, 1-1/2 inch leg, chisel point.
    - c. Tie Wire: 18 gage.
  - 3. At Horizontal Soffit Surfaces: Comply with CBC 2507.3 (DSA).
    - a. Staples (for wood): Zinc plated, 9 gage, ring shank, hook type, 3/4 inch crown, 2 inch leg.

- b. Tie Wire: 18 gage, double strand.
- C. Tie Wire: Annealed galvanized steel.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that substrates are ready to receive work and conditions are suitable for application.
- C. For exterior plaster and stucco on stud walls, verify that water-resistive barrier has been installed over sheathing substrate completely and correctly; see Section 07 25 00.
  - 1. Do not allow the control or expansion joints to interrupt or be lapped with the weather barrier.
- D. Do not begin until unacceptable conditions have been corrected.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 INSTALLATION - GENERAL**

- A. Install interior lath and furring for gypsum plaster in accordance with ASTM C841.
- B. Install metal lath and furring for Portland cement plaster in accordance with ASTM C1063.
- C. Install lath and furring for fire-rated assemblies in accordance with requirements of assembly as indicated.

#### **3.03 CEILING AND SOFFIT FRAMING INSTALLATION**

- A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above-ceiling work.
- C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Install furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
- G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- H. Laterally brace suspension system.

#### **3.04 CONTROL AND EXPANSION JOINT INSTALLATION**

- A. At unsheathed open framing, provide double stud construction behind control joint.
- B. Locate joints as indicated on drawings and comply with ASTM C1063.



1. Area of plaster panel not to exceed 144 sq ft for vertical surfaces.
    - a. Expansion Joint Spacing: 36 feet maximum on center and as indicated on drawings.
  2. Area of plaster panel not to exceed 100 sq ft for horizontal, curved or angled surfaces.
  3. Spacing between control joints not to exceed 18 ft in each direction.
    - a. Narrow panels should not exceed 12 feet in length.
  4. Area bounded by control joints not to exceed a length-to-width ratio of 2-1/2 to 1.
  5. Vertical control joints should pass through horizontal control joints. Vertical control joints must terminate at horizontal expansion joints.
  6. Joint Placement: Approved by Architect before plastering.
- C. Install expansion joints where an expansion joint occurs in base exterior wall.
- D. Install prefabricated joint accessories in accordance with ASTM C1063.
1. Install factory-made joints at reveal-to-reveal and reveal-to-control joint intersections.
- E. Discontinue metal lath at joint and apply 12 inch wide strip of flexible flashing behind each joint
- F. Hold casing beads back 3/8 to 1/4 inch from abutting frames and other elements to provide joint for sealant.
- G. Apply sealant at splices, intersections and terminals in accordance with Section 07 92 00 - Joint Sealants.

### **3.05 ACCESS PANELS INSTALLATION**

- A. Install access panels and rigidly secure in place.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position to provide convenient access to concealed work requiring access.

### **3.06 LATH INSTALLATION**

- A. Apply lath taut, with long dimension perpendicular to supports.
- B. Lap or nest ends of metal lath in accordance with ASTM C841.
- C. Secure end laps with tie wire where they occur between supports.
- D. Do not continue lath through control or expansion joints.
- E. Apply ribbed lath with self-furring ribs perpendicular to supports at soffits and horizontal surfaces.
  1. Lap sides of ribbed lath minimum 1-1/2 inches.
  2. Nest outside ribs of rib lath together.
  3. Attach lath to supports using specified screws at maximum 6 inches on center vertical and 16 inches on center horizontal.
  4. At horizontal metal lath application, secure lath to each support with specified screws.
- F. Expanded metal lath at vertical supports, apply self-furring "grooved" metal lath with self-furring rib perpendicular to supports.
  1. Install per Table 2507.2 California Building Code.

2. Maintain lath 1/4 inch away from vertical supports.
  3. At concrete or masonry, install with drill and drive fasteners, power or powder actuated fasteners in accordance with manufacturer's recommendations and ASTM C1063.
- G. Attach metal lath to supports using screws at maximum 12 inches on center.
  - H. Attach horizontal metal lath to metal supports using tie wire at maximum 6 inches on center vertical.
  - I. Attach non-metallic lath to metal supports using manufacturers recommended fasteners at maximum 7 inches on center.
  - J. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
  - K. Place corner bead with mesh at external wall corners; fasten at outer edges of lath only.
  - L. Place strip lath diagonally at corners of lathed openings. Secure rigidly in place.
  - M. Place strip lath centered over junctions of dissimilar backing materials on same plane. Secure rigidly in place.
  - N. Place base screeds at termination of plaster areas; secure rigidly in place.
    1. Install weep screeds at foundation. Install minimum 4 inches above earth or 2 inches above paved areas.
    2. To allow moisture to escape from a portland cement plaster (stucco) assembly, no sealant shall be placed at the bottom of the plaster termination.
  - O. Place 4 inch wide strips of lath centered over junctions of dissimilar backing materials, and secure rigidly in place.
  - P. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
  - Q. Place casing beads at terminations of plaster finish. Butt and align ends, cope or miter at corners. Secure rigidly in place, maximum 12 inches on centers..
  - R. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

### **3.07 FIELD QUALITY CONTROL**

- A. Inspection: Notify Architect minimum 2 days prior to scratch coat for inspection of all in-place lath and accessories.

### **3.08 TOLERANCES**

- A. Install accessories to lines and levels.
- B. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.
- C. Maximum Variation from True Position: 1/8 inch.

## **END OF SECTION**

## **SECTION 09 24 00 CEMENT PLASTERING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Cement plastering. CPL-1

#### **1.02 RELATED REQUIREMENTS**

- A. Section 08 31 00 - Access Doors and Panels: Access panels.
- B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum Sheathing: Solid backing at all exterior plaster.
- C. Section 09 22 36 - Lath: Lath, furring, beads, screeds, and joint accessories for plaster base.
- D. Section 09 91 13 - Exterior Painting: Finish paint over integral color plaster.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C150/C150M - Standard Specification for Portland Cement.
- B. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- C. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.
- D. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.
- E. TSIB (PAM) - Plaster Assemblies Manual, Technical Services Information Bureau.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide data on plaster materials and trim accessories.
- C. Samples:
  - 1. Submit two samples, 8 by 8 inch in size illustrating finish color and texture.
  - 2. Submit two samples of each type trim accessory.
- D. Evaluation Service Reports: Show compliance with specified requirements.
- E. Installer's Qualification Statement.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.
- B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

#### **1.06 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

- B. Mock-Up Panel: Construct a 4 foot wide by 8 foot high sample panel of plaster work at the jobsite demonstrating installation procedures, finish texture, and color. Show each phase of installation including framing and reinforcement.
- C. After color and texture samples have been approved and returned, construct a mock-up not less than as noted above in size, of each texture type, in location approved by Architect.
  - 1. Use workmen, equipment and techniques proposed for use on the project.
  - 2. The panel may be constructed as a portion of the finished work, provided the approved panel is clearly identified for future reference.
  - 3. The approved panel shall become the standard of comparison for cement plaster work for the project.
  - 4. If mock-up is not a part of building construction, it must be removed when directed by Architect after completion of project.

## **1.07 FIELD CONDITIONS**

- A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

## **PART 2 PRODUCTS**

### **2.01 CEMENT PLASTER APPLICATIONS**

- A. Lath Plaster Base: Metal lath.
  - 1. Plaster Type: Factory prepared plaster mix.
  - 2. Number of Coats: Three.
  - 3. First Coat: Apply to a nominal thickness of 3/8 inch.
  - 4. Second Coat: Apply to a nominal thickness of 3/8 inch.
  - 5. Leveling Coat: Apply to a nominal thickness of 1/32 to 1/16 inch.
  - 6. Finish: Acrylic.

### **2.02 FACTORY PREPARED CEMENT PLASTER**

- A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
  - 1. Provide continuous exterior insulation, with drainage grooves, as part of the system, by the same manufacturer.
    - a. See Technical Bulletin 60.110, TSIB (PAM).
  - 2. Provide weather resistive barrier as part of the system.
  - 3. Manufacturer - Basis of Design:
    - a. Omega Products International, Inc.; Super Cement with Crack Isolation System: [omega-products.com](http://omega-products.com).
  - 4. Other Acceptable Manufacturers:
    - a. Dryvit; Commercial Cement Plaster (CCP) 4: [www.dryvit.com](http://www.dryvit.com).

- b. LaHabra; FastWall 300: [www.lahabrastucco.com/#sle](http://www.lahabrastucco.com/#sle).
  - c. Omega Products International, Inc.; Super Cement with Crack Isolation System: [omega-products.com](http://omega-products.com).
  - d. Sika Corporation; Parex Armourwall 300: [www.parex.com/#sle](http://www.parex.com/#sle).
  - e. Sto Corp; Sto Powerwall: [www.stocorp.com/#sle](http://www.stocorp.com/#sle).
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Premixed One-Coat Base: Mixture of Type I Portland cement complying with ASTM C150/C150M, hydrated lime complying with ASTM C207, fibers and other approved ingredients; install in accordance with ASTM C926.
- 1. Manufacturers:
    - a. Omega Products International, Inc.; Diamond Wall Insulating One Coat System: [omega-products.com](http://omega-products.com).
- C. Premixed Base Coats: Mixture of cement, aggregate, fibers, and proprietary admixtures for scratch and brown coats; install in accordance with ASTM C926.
- D. Premixed Leveling Coat: Acrylic polymer-based blend approved for use with plaster manufacturer's base coat and finish materials.
- E. Painted Finish Coating: See Section 09 91 13.
- F. Primer: Acrylic, as recommended by coating manufacturer and compatible with plaster base coat.
- G. Premixed Textured Coating: Polymer modified acrylic coating, integrally colored, and trowel applied to substrates prepared in accordance with manufacturer's written installation instructions.
- 1. Color: As indicated on drawings.

## **2.03 ACCESSORIES**

- A. Lath: See Section 09 22 36.
- B. Finishing Accessories: See Section 09 22 36.
- C. Bonding Compound: Provide type recommended for bonding plaster to solid surfaces, complying with ASTM C932.
- D. Reinforcing Mesh: 4.5 oz/sq yd alkali-resistant mesh.
- E. Water-Resistive Barrier: See Section 07 25 00.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.
- C. Verify mechanical and electrical equipment and services located within areas to receive this work have been properly tested and approved.

### **3.02 PREPARATION**

- A. Roughen smooth concrete surfaces and apply bonding compound in accordance with manufacturer's written installation instructions.

### **3.03 MIXING**

- A. Mix only as much plaster as can be used prior to initial set.
- B. Mix materials dry, to uniform color and consistency, before adding water.
- C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

### **3.04 APPLICATION**

- A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
- B. Base Coats:
  - 1. Apply base coat(s) to fully embed lath and to specified thickness.
  - 2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.
- C. Leveling Coat:
  - 1. Apply leveling coat to specified thickness.
  - 2. Fully embed reinforcing mesh in leveling coat.
- D. Finish Coats:
  - 1. Cement Plaster:
    - a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
    - b. Apply desired surface texture while mix is still workable.
    - c. Float to a consistent finish.
  - 2. Primer and Acrylic Coatings:
    - a. Remove surface contaminants such as dust and dirt without damaging substrate.
    - b. Apply primer in accordance with manufacturer's instructions.
    - c. Apply finish coating in number of coats and to thickness recommended by manufacturer.
  - 3. Acrylic Finish Texture: Apply to a consistent finish.
    - a. TSIB (PAM) Fine Sand.
- E. Finish Painting Overcoat: See Section 09 91 13 - Exterior Painting.

### **3.05 TOLERANCES**

- A. Maximum Variation from True Flatness: 1/4 inch in 10 feet.

### **3.06 REPAIR**

- A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

**END OF SECTION**

## **SECTION 09 30 00 TILING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Tile for floor applications. T-2 & G-1.
- B. Tile for wall applications. T-1, T-2, T-3, T-4, & G-2.
- C. Cementitious backer board as tile substrate.
- D. Ceramic trim.
- E. Non-ceramic trim. TB-1

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 22 40 00 - Plumbing Fixtures: Shower receptor.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).
- C. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
- D. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar.
- E. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar.
- F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive.
- G. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar.
- H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy.
- I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.



- J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
- K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.
- L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- M. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar.
- N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar.
- P. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.
- Q. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.
- R. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- S. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- T. ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar.
- U. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- V. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.
- W. ANSI A136.1 - American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile.
- X. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- Y. ANSI/NFSI B101.3 - Test Method for Measuring Wet DCOF of Common Hard Surface Floor Materials.
- Z. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products.
- AA. ASTM C847 - Standard Specification for Metal Lath.
- BB. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- CC. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products.
- DD. SCAQMD 1168 - Adhesive and Sealant Applications.
- EE. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
  - 1. Prior to shipment of tile to jobsite, deliver Master Grade Certificates to Architect, complying with TCNA/ANSI A137.1.
- G. Installer's Qualification Statement:
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Tile: One box, minimum of 24 pieces of each size, color, and surface finish combination.

#### **1.06 QUALITY ASSURANCE**

- A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

#### **1.07 MOCK-UP**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
  - 1. Minimum size of mock-up is indicated on drawings.
  - 2. Approved mock-up may remain as part of the Work.

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

## **1.09 FIELD CONDITIONS**

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Requirements for Persons with Disabilities: Provide ceramic tile flooring meeting slip-resistant requirements of California Code of Regulations (CCR), Title 24, Part 2, Chapter 11B and ADA Standards, latest amendment.
  - 1. Tile flooring surface shall be stable, firm, and slip resistant. CBC Section 11B-302.1 General.
  - 2. Tile flooring Surface shall demonstrate a dynamic coefficient of friction of at least 0.42 wet per DCOF AcuTest ANSI A137.1 Section 9.6 and ANSI/NFSI B101.3(using a BOT-3000 testing unit) will be accepted as meeting the intent of slip resistance; CBC 11B-302 Floor or Ground Surfaces and ADA Standards.
    - a. Ramp surface: Provide wet DCOF value of 0.46.
- B. California Plumbing Code:
  - 1. Floor Drains:
    - a. Inspection of Work - All surfaces prepared by others shall be inspected by the tile installer before starting tile work and all unsatisfactory conditions reported to the Administrative Authority. Starting tile work by the tile installer shall be considered as acceptance of surfaces prepared by others.
    - b. Surfaces - All surfaces to receive tile work shall be clean, structurally sound, and slopes shall to conform to CBC.

Note: No tile work shall proceed until the pan and drain construction has been inspected and approved by the Administrative Authority, where required.
  - 2. Definition:
    - a. Receptor: An approved plumbing fixture or device of such material, shape, and capacity as to adequately receive the discharge from indirect waste pipes, so constructed and located as to be readily cleaned. CPC 220.0

### **2.02 TILE**

- A. Manufacturers:
  - 1. American Olean Corporation: [www.americanolean.com/#sle](http://www.americanolean.com/#sle).
  - 2. Dal-Tile Corporation: [www.daltile.com/#sle](http://www.daltile.com/#sle).
- B. Glazed Wall Tile: ANSI A137.1 standard grade.
  - 1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.

2. Size: As indicated on Drawings, nominal.
3. Edges: Cushioned.
4. Surface Finish: High gloss.
5. Color(s): To be selected by Architect from manufacturer's standard range.
6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

### **2.03 TRIM AND ACCESSORIES**

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
  1. Applications:
    - a. Open Edges: Bullnose.
    - b. Inside Corners: Jointed.
    - c. Floor to Wall Joints: Cove base.
  2. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
  1. Applications:
    - a. Floor to wall joints.
      - 1) Aluminum: Schuler - DILEX-AHK.
  2. Manufacturers:
    - a. Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle).
    - b. Genesis APS International: [www.genesis-aps.com/#sle](http://www.genesis-aps.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
  1. Thickness: 1/2 inch.
  2. Material: Solid surface acrylic resin, mineral filler, and pigments; non-porous, color and pattern consistent throughout thickness.
    - a. Solid Polymer Fabricated: ASTM D638.
    - b. Color and Pattern: As indicated on drawings.
    - c. Manufacturers:
      - 1) Formica Corporation Product: Signatures: [www.formica.com](http://www.formica.com).
      - 2) Avonite Surfaces Product Avonite: [www.avonitesurfaces.com](http://www.avonitesurfaces.com).
      - 3) Dupont Product: Corian: [www.corian.com](http://www.corian.com).
      - 4) Panolam Industries International, Inc.(Nevamar); Product Fountainhead: [www.nevamar.com](http://www.nevamar.com).
      - 5) Wilsonart International, Inc Product: Gibraltar: [www.wilsonart.com](http://www.wilsonart.com).

3. Color and Pattern: As indicated on drawings.
4. Applications:
  - a. At doorways where tile terminates.

## 2.04 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of low emitting materials. Conform to SCAQMD 1168 and BAAQMD 8-51.
- C. Manufacturers:
  1. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  2. H.B. Fuller Construction Products, Inc: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  3. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  4. Mapei Corporation: [www.mapei.com](http://www.mapei.com).
  5. Merkrete, by Parex USA, Inc: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
  6. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
  1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
  2. Products:
    - a. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. Mapei Corporation; Ultraflex 2: [www.mapei.com](http://www.mapei.com).
- E. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
  1. Applications: Where indicated on drawings.
  2. Products:
    - a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
- F. Organic Adhesive: ANSI A136.1, thinset mastic type.
  1. Use Type I in areas subject to prolonged moisture exposure.
  2. Products:
    - a. ARDEX Engineered Cements; ARDEX D14: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Custom Building Products; ReliaBond Ceramic Tile Adhesive - Type 1: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - c. LATICRETE International, Inc; LATICRETE 15 Premium Mastic: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).

- d. MAPEI Corporation; Type 1: [www.mapei.com](http://www.mapei.com).
  - e. Merkrete, by Parex USA, Inc; Merkrete Merstik: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Mortar Bond Coat For Exterior Glue Plywood: ANSI A118.11.
- 1. Applications: Use this type of bond coat where thin-set installation is indicated over plywood.
  - 2. Products:
    - a. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE 254 Platinum: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Merkrete, by Parex USA, Inc; Merkrete 7D10 Dust Less Thin Set: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
- 1. Products:
    - a. ARDEX Engineered Cements; A 38: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Custom Building Products; ProLite Tile & Stone Mortar: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
    - c. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - d. Merkrete, by Parex USA, Inc; Merkrete Underlay C: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - e. Proflex Products, Inc; MSI - Mud Set Installation: [www.proflex.us/#sle](http://www.proflex.us/#sle).
    - f. QuikCrete; 4:1 Deck Mud: [www.custombuildingproducts.com](http://www.custombuildingproducts.com)

## 2.05 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
  - 1. Basis of Design: Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - 2. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 3. Bonsal American, Inc; ProSpec Sanded Tile Grout 700: [www.prospec.com](http://www.prospec.com)
  - 4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 5. MAPEI Corporation: [www.mapei.com](http://www.mapei.com).
  - 6. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
- C. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
  - 1. Applications: Use this type of grout where indicated on exterior over plaster.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As selected by Architect from manufacturer's full line.

4. Products:
  - a. Basis of Design: Custom Building Products; Fusion Pro Single Component Grout: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - b. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  - c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - d. Mapei, Inc.; Keracolor S Grout unsanded: [www.mapei.com](http://www.mapei.com)
  - e. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
  1. Applications: Toilet room floors.
  2. Color(s): As selected by Architect from manufacturer's full line.
  3. Products:
    - a. Basis of Design: Custom Building Products; CEG-Lite 100% Solids Commercial Epoxy Grout: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - d. MAPEI Corporation; Kerapoxy Epoxy Grout: [www.mapei.com](http://www.mapei.com).
    - e. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
  1. Applications: Toilet room floors.

## **2.06 MAINTENANCE MATERIALS**

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
  1. Applications: Between tile and plumbing fixtures.
  2. Color(s): As selected by Architect from manufacturer's full line.
  3. Products:
    - a. Custom Building Products; Commercial 100% Silicone Caulk: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE LATASIL: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. MAPEI Corporation; Mapesil Silicone Sealant: [www.mapei.com](http://www.mapei.com).
    - d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
  - 1. Composition: Water-based colorless silicone.
  - 2. Products:
    - a. Specified Manufacturer: Aqua-Mix: [www.custombuildingproducts.com](http://www.custombuildingproducts.com); local representative Dale Roberts (951) 255-0243.
    - b. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Tile Sealer: Stain protection for ceramic tile and natural stone tile.
  - 1. Products:
    - a. Custom Building Products; Aqua Mix Enrich 'N' Seal: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. STONETECH, a division of LATICRETE international, Inc; STONETECH Heavy Duty Stone Sealer: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- D. Grout Release: Temporary, water-soluble pre-grout coating.
  - 1. Products:
    - a. Custom Building Products; Aqua Mix Grout Release: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.07 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  - 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
  - 2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 20 mils, maximum.
    - c. Products:
      - 1) Custom Building Products; Custom 9240 Waterproofing and Anti-Fracture Membrane: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
      - 2) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
      - 3) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
      - 4) MAPEI Corporation; Mapelastic HPG w/Fiberglass Mesh: [www.mapei.com](http://www.mapei.com).
      - 5) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
      - 6) Substitutions: See Section 01 60 00 - Product Requirements.
- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.



1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
  - a. Material: Synthetic rubber or Acrylic.
  - b. Thickness: 25 mils, minimum, dry film thickness.
  - c. Products:
    - 1) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - 2) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - 3) LATICRETE International, Inc; LATICRETE HYDRO BAN: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - 4) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - 5) Protecto Wrap; Protecto LM: [www.protectowrap.com/#sle](http://www.protectowrap.com/#sle).
    - 6) Substitutions: See Section 01 60 00 - Product Requirements.
- C. Reinforcing Mesh: 2 by 2 inch size weave of 16/16 wire size; welded fabric, galvanized.
- D. Membrane at Walls:
  1. Material: No. 15 asphalt saturated felt.
- E. Metal Lath: ASTM C847 Flat diamond mesh, of weight to suit application, galvanized finish.
- F. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
  1. Products:
    - a. Custom Building Products; WonderBoard Lite Backerboard: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

## **PART 3 EXECUTION**

### **3.01 REGULATORY REQUIREMENTS FOR INSTALLATION**

- A. California Plumbing Code:
  1. Floor Drains:
    - a. Floors shall be sloped maximum 2% to drains. CPC 411.4.

### **3.02 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
  1. Walls and floors to be level, plumb and true to within the listed for each applicable TCNA (HB) assembly method used.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 05 61.
  - 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
  - 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.03 PREPARATION**

- A. Protect surrounding work from damage.
- B. Shade work from direct sunlight during tile installation as needed to prevent rapid evaporation caused by excessive heat.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

### **3.04 INSTALLATION - GENERAL**

- A. Waterproof/Anti-Fracture Membrane Application: Comply with manufacturer's written instructions and recommendations for substrate, tile setting method and Project conditions.
- B. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19, manufacturer's instructions, and TCNA (HB) recommendations.
- C. Expansion Joints: Provide expansion joints at locations and spacings as recommended by TCNA (HB) Detail EJ171 and as indicated on Drawings. Keep joints free of setting bed mix and grout.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- G. Form internal angles square and external angles bullnosed.
- H. Install non-ceramic trim in accordance with manufacturer's instructions.
- I. Install thresholds where indicated.
- J. Sound tile after setting. Replace hollow sounding units.
- K. Keep control and expansion joints free of mortar, grout, and adhesive.
- L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

- M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

### **3.05 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

### **3.06 INSTALLATION - FLOORS - MORTAR BED METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
  - 1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
- B. Cleavage Membrane: Lap edges and ends.
- C. Waterproofing Membrane: Install as recommended by manufacturer .
- D. Mortar Bed Thickness: 1-1/4 inch, unless otherwise indicated.

### **3.07 INSTALLATION - WALL TILE**

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- C. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

### **3.08 GROUTING**

- A. Joint Width: As follows unless indicated otherwise on Drawings.
  - 1. Glazed Wall Tile, Unmounted: As determined by spacing lugs.
  - 2. Glazed Floor Tile, Unmounted: 1/8 inch.
  - 3. Porcelain Floor Tile: 1/4 inch.
  - 4. Mounted Tile: As determined by factory-produced spacing.
  - 5. Trim and Accessories: Match adjoining tile units.
- B. Wall Tile Grouting: TCNA/ANSI A108.10, latex-portland cement.
- C. Floor Tile Grouting: TCNA/ANSI A108.10, latex-portland cement.
- D. Do not begin grouting tiles until they are firmly set and a minimum of 48 hours of curing has occurred.
- E. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- F. When using proprietary grout, comply with manufacturer's instructions and recommendations unless otherwise more stringent requirements are specified.

- G. Force maximum amount of approved grout into joints in accordance with pertinent recommendations contained in TCNA/ANSI A108.10.
- H. Fill joints of cushion-edge tile to depth of cushion; fill joints of square-edge tile flush with tile surface.
- I. Fill all gaps and skips.
- J. Do not permit mortar or mounting mesh to show through grouted joints.
- K. Provide hard finished grout which is uniform in color, smooth, and without voids, pin holes, or low spots.
- L. Leave tile clean.

### 3.09 TOLERANCES

- A. Subsurface Guidelines: Refer to TCNA (HB) for a complete guidelines.

Mortar Bed	1/4 inch: 10 feet
Thin Bed w/ cementitious bonding material w/ Tiles <15"	1/4 inch: 10 feet from plane Maximum 1/16 inch variation in 12 inches from high points.
Thin Bed w/ cementitious bonding material w/ Tiles any side >15"	1/8 inch: 10 feet from plane Maximum 1/16 inch variation in 24 inches from high points.
Thin Bed w/ organic adhesive bonding material w/ Tiles any side >15"	1/16 inch in 3 feet No abrupt irregularities >1/32 inch

- B. Lippage Guidelines: Refer to TCNA (HB) for a complete guidelines.

Tile Type	Tile Size (in.)	Joint Width (in.)	Allowable Lippage (in.)
Glazed Wall/ Mosaics	1 x 1 to 6 x 6	1/16 to 1/8	1/32
Quarry	6 x 6 to 8 x 8	1/4 or greater	1/16
Pressed Floor and Porcelain Tiles	All	1/16 to less than 1/4	1/32
Pressed Floor and Porcelain Tiles	All	1/4 or greater	1/16

### 3.10 JOINT SEALANT

- A. Apply sealant after tile is grouted, grout is cured and tile field is thoroughly clean and dry.
- B. Seal between tile and all penetrating elements.
- C. Seal perimeter of tile field where tile base is not provided.
- D. Sealant Locations shall include:

1. Around plumbing penetrations.
  2. Around door frames and other items set in wall.
- E. Refer to Section 07 92 00 - Joint Sealants for additional requirements.

### **3.11 GROUT SEALER**

- A. Clean grout and apply sealer in accordance with manufacturer's instructions and recommendations.

### **3.12 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide manufacturer's field representative to inspect waterproofing.
- C. Test shower linings with standing water to the top of the rough threshold for a period of minimum 24 hours. CPC 418.1.
1. A test plug shall be so placed that both the upper and under sides of the lining shall be subjected to test at its point of contact with the sub-drain.
    - a. When the test plug is removed, all of the test water shall drain out by gravity through the weep holes.
    - b. A ring of non-absorbent material must be placed around the weep holes to keep them open when the finish materials are installed.
  2. Verify water level has not changed beyond normal evaporation.
  3. Inspect floor below and adjacent surfaces for leaks.
- D. Repair or remove and reinstall as required.
- E. Repeat until a satisfactory result is achieved.

### **3.13 CLEANING**

- A. Clean tile and grout surfaces.

### **3.14 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

## **END OF SECTION**

## **SECTION 09 51 00 ACOUSTICAL CEILINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 21 00 - Thermal Insulation: Acoustical insulation.
- C. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC) - Air Outlets and Inlets: Air diffusion devices in ceiling.
- D. Division 26 - Electrical - Interior Lighting: Light fixtures in ceiling system.
- E. Division 27 - Communications - Public Address Systems: Speakers in ceiling system.

#### **1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
- H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- I. CHPS (HPPD) - High Performance Products Database.
- J. UL (GGG) - GREENGUARD Gold Certified Products.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

## **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Evaluation Service Reports: Show compliance with specified requirements.
  - 1. Submit copies of the suspension system manufacturer's current ICC Evaluation Service Report.
- E. Samples: Submit two samples 12 by 12 inch in size illustrating material and finish of acoustical units.
- F. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Manufacturer's qualification statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 1.0 percent of amount installed.
  - 3. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

## **1.06 QUALITY ASSURANCE**

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## **1.07 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com/#sle](http://www.armstrong.com/#sle).
  - 2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 3. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Suspension Systems:

1. Same as for acoustical units.
2. Rockfon, LLC: [www.rockfon.com/#sle](http://www.rockfon.com/#sle).
3. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 PERFORMANCE REQUIREMENTS**

- A. Flame Spread Rating: Provide acoustical ceiling units bearing the label of Underwriters' Laboratories, or other testing agency acceptable to the State Fire Marshal, indicating that the units provide the specified flame spread rating.
  1. Class A Flame spread rating 0-15, smoke developed 0-15 per ASTM E84 for each acoustical tile type.
- B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
  1. Local authorities having jurisdiction.
  2. ICC-ES Evaluation Report No. ESR-1308.
  3. Seismic Requirements: Furnish and install suspension systems in accordance with the suspension system manufacturer's current ICC Evaluation Service Report; the California Building Code (CBC), Title 24 Part 2, Table No.1607; CBC Title 24 Part 2, Chapter 25.

## **2.03 ACOUSTICAL UNITS**

- A. Acoustical Units - General: ASTM E1264, Class A.
  1. VOC Content: Certified as Low Emission by one of the following:
    - a. Product listing in UL (GGG).
    - b. Product listing in CHPS (HPPD).
- B. Total System Weight: Less than 4 PSF.
- C. Acoustical Panels, Type ACT-1: Mineral fiber with membrane-faced overlay, with the following characteristics:
  1. Classification: ASTM E1264 Type IV.
    - a. Form: 2, water felted.
    - b. Pattern: "E" - lightly textured.
  2. ACT-1 Size: 24 by 48 inches.
  3. Thickness: 3/4 inch.
  4. Panel Edge: Square.
  5. Tile Edge: Square.
  6. Color: White.
  7. Suspension System Type TBAR-1: Exposed grid.
  8. Basis of Design Product: Ultima No. 1912 as manufactured by Armstrong World Industries, or equal.
- D. Acoustical Panel Canopies, Type ACP-1 through 6: Glass fiber panels suspended by hanger wire or rods attached to anchor points on panel back.



1. Classification: ASTM E1264 Type XII.
  - a. Form: 2, cloth.
  - b. Pattern: "G" - smooth.
2. Size and Configuration: As indicated on drawings.
3. Shape: As indicated on drawings.
4. Thickness: 1 inch.
5. Basis of Design Product: Indicated on drawings as manufactured by Autex Acoustics, or equal.

## **2.04 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
  1. Materials:
    - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System, Type TBAR-1: Hot-dipped galvanized steel grid with cap.
  1. Application(s): Seismic.
  2. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
  3. Profile: Tee; 15/16 inch face width. (9/16 inch may be acceptable in selected locations)
    - a. Main Runners:
      - 1) Armstrong: Heavy Duty Prelude XL 7301, exposed T.
    - b. Cross Tees - "Stake-on end", Stepped End:
      - 1) Armstrong: XL7328 (24 inch grid), XL7341 (48 inch grid).
    - c. Edge Trim:
      - 1) Armstrong Angle Molding: 7800, 7/8", Prelude 7871 Shadow molding with
  4. Finish: Baked enamel.
  5. Color: White, unless noted otherwise.
    - a. Certain ceilings do have specific color requirements.
  6. TBAR-1 Basis of Design Product: Prelude 7301 main runners and XL7320 cross runners - ICC ESR 1308 as manufactured by Armstrong World Industries, or equal.
  7. Products:
    - a. Armstrong World Industries, Inc: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
    - b. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
    - c. Rockfon: [www.rockfon.com](http://www.rockfon.com).
    - d. USG Corporation; Donn Brand ZXLA 15/16 inch Acoustical Suspension System: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
      - 1) ICC ESR-1222 and LARR 25764.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.

- C. Drywall Suspension System: Hot-dipped galvanized steel grid and cap.
  - 1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
    - a. ICC ESR-1289, 8900 Series Ceiling System.
  - 2. Profile: Tee; 1-1/2 inch face width.
  - 3. Finish: G40 Galvanized per ASTM C645.
  - 4. Basis of Design Product: HD8906 HD Drywall Main Beam, XL8945P Cross Runner, with KAM21020EQ Knurled Angle (Channel) Molding as manufactured by Armstrong World Industries, or equal.

## **2.05 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.105 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
  - 1. Conform to seismic requirements indicated in the ESR approval documents.
- E. Perimeter Moldings: Same metal and finish as grid.
  - 1. Size: As required for installation conditions and specified Seismic Design Category.
- F. Acoustical Insulation: ASTM C665 friction fit type, unfaced batts.
  - 1. Thickness: 2 inch.
  - 2. Size: To fit acoustical suspension system.
- G. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
  - 1. Complete and obtain approval of mechanical, electrical and other work above the ceiling line, before start of acoustical ceiling installation.
- B. Coordinate the location of hangers with other work.

### **3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

### **3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Cut to fit irregular grid and perimeter edge trim.
  - 2. Make field cut edges of same profile as factory edges.
  - 3. Double cut and field paint exposed reveal edges.
- F. Install hold-down clips on panels within 20 ft of an exterior door.

### **3.05 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### **3.06 ADJUSTING AND CLEANING**

- A. Replace loose and damaged tile and panels when directed.
- B. Touch-up all damaged finish.
- C. Leave all surfaces clean and free from markings and other disfigurements.
- D. Remove all debris resulting from the work of this section.

## **END OF SECTION**

## **SECTION 09 54 23 LINEAR METAL CEILINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Linear metal ceilings and soffits.
- B. Suspended metal support system and perimeter trim.
- C. Supplementary insulation above ceiling.

#### **1.02 RELATED REQUIREMENTS**

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

#### **1.04 DESIGN REQUIREMENTS**

- A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.
- B. Performance Characteristics: Provide manufacturers standard system which, when installed, provides the following minimum requirements for structural performance.
  - 1. Wind Load Resistance: for exterior installations, provide components that are capable of with standing general wind loads of up to 40 psf without damage.
  - 2. Specific wind loads at given areas, see specific product requirements listed in Part 2.

#### **1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
- C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

#### **1.06 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

- B. Product Data: Furnish for component profiles.
  - 1. Submit manufacturer's product specifications and installation instructions for each metal ceiling material, and for suspension system, including certified laboratory test reports and other data required to show compliance with these specifications.
- C. Shop Drawings: Indicate ;
  - 1. Reflected ceiling plans; location of metal ceilings and suspension systems; location of light fixtures, diffusers, speakers, sprinkler heads, and other exposed to view items; list of materials; dimensions, jointing, method of hanger attachment, fastenings and other pertinent information. Include calculations indicating compliance with seismic resistance requirements.
- D. Samples: Submit samples 12 inch length in size illustrating color and finish of exposed to view components.
  - 1. Include metal ceiling panels, filler strips, edge moldings and each type of carrier channel for linear metal ceilings.
  - 2. Panels shall show the full range of color and finish to be expected in the completed work
  - 3. Submit full range of Luxacote color and finish samples for selection by the Architect when no color selection has been indicated.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements for additional provisions.
  - 2. Extra Linear Panels: Ten, standard length.
- H. CHPS Submittal: Documentation of recycled content.

#### **1.07 QUALITY ASSURANCE**

- A. Designer Qualifications for Seismic-Wind Design: Under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at California.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section.
- D. Compatibility: Furnish only associated components that have been recommended by the manufacturer of the Soffit and Cladding system.

#### **1.08 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Locate mock-up where directed.
- C. Mock-up may remain as part of the work.

#### **1.09 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

- B. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
- C. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

#### **1.10 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS:**

- A. Seismic Requirements: Furnish and install suspension systems in accordance with the suspension system manufacturer's current ICC Evaluation Service Report; the California Building Code (CBC), Title 24 Part 2, Table No.1607; CBC Title 24 Part 2, Chapter 25.

#### **2.02 LINEAR METAL CEILINGS**

- A. Linear Metal Ceiling and Soffit System: Panels, suspension members, trim, and accessories as required to provide a complete system.
- B. AWC-1 Basis of Design Product: Indicated on Drawings as manufactured by Rulon International, or approved equal.
- C. AWC-2 Basis of Design Product: Indicated on Drawings as manufactured by Rulon International, or approved equal.
- D. Performance Requirements:
  - 1. Design to support imposed loads of indicated items without eccentric loading of supports.
  - 2. Design for maximum deflection of 1/360 of span.
  - 3. Design to resist wind load required by CBC and ASCE 7.
  - 4. Design to resist seismic load by using practices specified in ASTM E 580.
  - 5. Surface Burning Characteristics: Class A Flame spread index of 25, smoke developed index of 50, when tested in accordance with ASTM E84.
  - 6. Systems Located Outside Building Envelope:
    - a. Accommodate wind and suction loads and wind uplift to resist minimum 40 psf without damage.

#### **2.03 COMPONENTS**

- A. Linear Metal Panels:
  - 1. Type: Linear panel with reveals; snap-in installation.
    - a. Size and Configuration: As indicated on drawings.
    - b. Panel Profile: Channel shaped with square edges.
    - c. Spacing: 3/4 inch reveal between panels.

- B. Acoustical Backer: Manufacturer's standard non-woven fabric; as required to achieve specified acoustic performance.
- C. Edge Molding and Splices: Same material, thickness, and finish as linear panels.
- D. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
- E. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
- F. Suspension Members: Formed steel sections, with integral attachment points; galvanized (G90) finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- G. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.
- H. Subgirt Members: Hot-dipped galvanized or electro-galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear ceiling and accessories.
- I. Insulation: ASTM C665, glass fiber batt, friction fit; comply with the following:
  - 1. Facing: Unfaced.
- J. Touch-up Paint For Concealed Items: Zinc rich type.

## **2.04 FABRICATION**

- A. Shop cut linear panels to accommodate mechanical and electrical items.
- B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels ; back brace internal corners.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Verify that field measurements are as indicated.
- E. Commencement of work will signify acceptance of above indicated materials and surfaces as satisfactory.

### **3.02 INSTALLATION**

- A. Suspension Components:
  - 1. Install after above-ceiling work is complete in accordance with ASTM C 636/C 636M and ASTM C 636/C 636M.
  - 2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.

3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
  4. Locate suspension system for linear panel layout on room axis according to reflected plan.
- B. Linear Metal Ceiling:
1. Install linear panels and other system components in accordance with manufacturer's instructions.
  2. Align end joints.
  3. Butt interior end joints tight.
  4. Set exterior end joints with 1/16 inch gap for expansion and contraction.
  5. Provide expansion joints to accommodate plus or minus 1 inch movement and maintain visual closure.
  6. Field miter corners at changes in panel direction.
  7. Install filler strips between linear panels at interior locations.
  8. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
  9. Install end caps at sight-exposed ends of linear panels.
  10. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.
- C. Insulation: Install above panel members; fit tight between grid members ; place insulation with facing side down.

### **3.03 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.
- C. Maximum Variation From Dimensioned Position: 1/4 inch.

### **3.04 CLEANING**

- A. Clean surfaces.
- B. Replace damaged or abraded components.
- C. Removing discolorations and foreign matter, and touch up abraded spots and edges (if any) with the same paint as was used in the factory-applied finish of the ceiling components.

## **END OF SECTION**



## **SECTION 09 65 00 RESILIENT FLOORING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Resilient tile flooring. LVT-1, LVT-2, LVT-3, & LVT-4.
- B. Resilient base. RB-1
- C. Installation accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- D. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
  - 1. Remedial Floor coating is required under all resilient flooring.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
- D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Verification Samples: Submit two samples, 2 by 2 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

- F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 100 square feet of each type and color.
  - 3. Extra Wall Base: 50 linear feet of each type and color.
  - 4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

#### **1.07 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Provide products complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
- B. Requirements for Physically Disabled: Provide flooring meeting slip-resistant requirements of California Code of Regulations (CCR), Title 24, Part 2, Chapter 11B and ADA Standards, latest amendment.
  - 1. Flooring surface shall be stable, firm, and slip resistant. CBC Section 11B-302.1 General.

2. Flooring surface shall demonstrate a dynamic coefficient of friction of at least 0.42 per DCOF AcuTest ANSI 137.1 Section 9.6 and ANSI B101.3 (using a BOT-3000 testing unit) will be accepted as meeting the intent of slip resistance; CBC 11B-302 Floor or Ground Surfaces and ADA Standards.
    - a. Ramp surface: Provide DCOF value of 0.46.
  3. Provide minimum 2-inch contrasting color (70% recommended) warning stripe of material at least as slip resistant as the other treads of the stairs, 1-inch maximum from edge of nosing and top landing. CBC 11B-5041.4.
    - a. At interior stairs, provide warning stripe at top landing and bottom tread nosing only.
  4. Treads, Risers, and Nosings: CBC Section 11B-504
    - a. Interior stairs shall have the upper approach and lower tread of each flight marked by a stripe providing clear visual contrast. Exterior stairs shall have the upper approach and all treads marked by a stripe providing clear visual contrast.
    - b. The stripe providing clear visual contrast shall be a minimum of 2 inches wide to a maximum of 4 inches wide placed parallel to, and not more than 1 inch from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.
    - c. The radius of curvature at the leading edge of the tread shall be no greater than 1/2 inch. Nosings that project beyond risers shall have the underside of the leading edge curved or beveled. The maximum angle for a riser to slope under the tread shall be 30 degrees from vertical. Nosings shall extend 1-1/4 inch maximum over the tread below.
    - d. Treads shall be 11 inches deep minimum. Risers shall be 7 inches high maximum and 4 inches high minimum. All steps on a flight of stairs shall have uniform riser heights and uniform tread depths. Open risers are not permitted .
- C. Comply with CalGreen Building Standards: 80 percent of the installed resilient flooring shall meet one of the following:
1. VOC Content: Certified as Low Emission by one of the following :
    - a. SCS Floorscore; [www.scs-certified.com](http://www.scs-certified.com). CalGreen 5.504.4.6.1.
    - b. Compliant with the VOC emission limits and testing requirements specified in the California Department of Public Health's 2010 "Standard Method for the Testing and Evaluation Chambers", Version 1.1, February 2010. CalGreen 5.504.4.6.2.
    - c. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database; [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm). CalGreen 5.504.4.6.3.
    - d. Products certified under UL GreenGuard Gold; [www.green-guard.org](http://www.green-guard.org). CalGreen 5.504.4.6.4.

## **2.02 ENVIRONMENTALLY PREFERABLE PRODUCTS**

- A. Comply with ANSI / NSF 332.

## **2.03 TILE FLOORING**

- A. (LVT) Luxury Vinyl Tile: Printed film type, with transparent or translucent wear layer.
  - 1. Basis of Design Product: Indicated on drawings as manufactured by Shaw Contract, or approved equal.
  - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
  - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
  - 4. VOC Content Limits: As specified in Section 01 61 16.
  - 5. NSF 332 Certification: Gold level.
  - 6. Wear Layer Thickness: 0.020 inch.
  - 7. Total Thickness: 0.125 inch.
  - 8. Color: As indicated on drawings.

## **2.04 RESILIENT BASE**

- A. Resilient Base - Type RB-1: ASTM F1861, Type TS rubber, vulcanized thermoset; Style B, Cove.
  - 1. Manufacturers:
    - a. Armstrong; Wall Base: [www.armstrongflooring.com](http://www.armstrongflooring.com).
    - b. Johnsonite, a Tarkett Company: [www.johnsonite.com](http://www.johnsonite.com).
    - c. Mannington Commercial; Burke: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
    - d. Roppe Corporation: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
  - 3. Height: 4 inches.
  - 4. Thickness: 0.125 inch.
  - 5. Finish: Satin.
  - 6. Length: 4 foot sections.
  - 7. Color: As indicated on drawings.
  - 8. Accessories: Premolded external corners and internal corners.

## **2.05 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
  - 1. VOC Content Limits: As specified in Section 01 61 16.

- C. Moldings, Transition and Edge Strips: Same material as flooring.
- D. Filler for Coved Base: Plastic.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 05 61.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- C. Environmental Condition: Comply with flooring manufacturer's instructions and recommendations.
  - 1. Verify that ambient and surface temperatures and humidity conditions are in compliance.
- D. Verify that required floor-mounted utilities are in correct location.
- E. Material Inspection:
  - 1. In accordance with manufacturer's installation requirements, visually inspect materials prior to installation.
  - 2. Material with visual defects shall not be installed.
  - 3. Labor costs required to replace material installed with visual defects shall be the responsibility of the installation contractor.

### **3.02 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.
- B. Clean substrate.

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of sub-floor conditions. Beginning of installation means acceptance of existing substrate and site conditions and assumes responsibility for correcting unsuitable conditions at no additional cost to the Owner.
- B. Install in accordance with manufacturer's written instructions.
  - 1. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
- C. Adhesive-Applied Installation:
  - 1. Spread only enough adhesive to permit installation of materials before initial set.
  - 2. Fit joints and butt seams tightly.

3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- F. Install feature strips where indicated.

### **3.04 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

### **3.05 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### **3.06 FIELD QUALITY REQUIREMENTS**

- A. Manufacturer's Field Services: Upon Owner's request and with at least 72 hours notice, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

### **3.07 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. Installation Clean-Up: Upon completion of installation in a room or area, clean flooring and adjacent surfaces.
  1. Sweep or vacuum floor thoroughly.
  2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
  3. Remove excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.
- D. Initial Cleaning: After adhesive has set but no sooner than 5 days after installation, wash resilient tile flooring with a neutral type cleaning solution in accordance with manufacturer's instructions and recommendations. Rinse thoroughly with clear, cool water but do not flood floor.
  1. After completion of installation, apply one coat of polish, if recommended by manufacturer, and buff to even luster.
  2. After final cleaning, apply second coat of polish as recommended by tile manufacturer and buff to even luster.

- E. Final Cleaning: Thoroughly clean resilient tile flooring and accessories in accordance with final cleaning specified in Section 01 70 00 - Execution and Closeout Requirements.
  - 1. Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of Project.
  - 2. Clean resilient flooring by method recommended by resilient flooring manufacturer, including stripping and application of additional floor polish and buffing to even luster.

### **3.08 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. From the time of laying until Acceptance, protect flooring from damage.
  - 1. Lay reinforced kraft paper runners and provide barricades and signs as necessary to prevent construction traffic on completed installations.
  - 2. Protect resilient flooring against damage from rolling loads for initial period following installation by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.
  - 3. Remove and replace defects which develop such as damaged, loose or broken tile and resilient accessories.

**END OF SECTION**

## **SECTION 09 68 16 CARPETING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Carpet, stretched-in with cushion underlay and direct-glued. CPT-2 & CPT-3.
- B. Removal of existing carpet. CPT-1
- C. Resilient base.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 01 74 19 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet scrap, new cushion scrap, removed carpet, and removed carpet cushion.
- C. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.
- D. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
- E. Section 09 68 13 - Tile Carpeting.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- D. CRI 104 - Standard for Installation of Commercial Carpet.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.
- D. Samples: Submit two samples 12 by 12 inch in size illustrating color and pattern for each carpet material specified.
- E. Submit two, 6 inch long samples of resilient base, edge strip, and base gripper for each color specified.



- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- H. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional requirements.
  - 2. Extra Carpet: 200 sq ft of each type, color, and pattern installed.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

#### **1.06 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
  - 1. Store inside, in well ventilated area, protected from weather, moisture and soiling. Store rolls flat, not standing on end.
- B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Deliver carpet materials in original mill protective wrapping with mill register numbers and tags attached.
- D. Ventilate installation area during installation and for 72 hours after installation.

#### **1.07 WARRANTY**

- A. Carpet Warranty: Provide 10-year Commercial Limited Warranty.
- B. Extended Warranty: Provide extended warranty for a period of 25 years after "Notice of Completion". Covering the following:
  - 1. Edge raveling and zippering.
  - 2. Wear exceeding 10 percent of face yarn weight.
  - 3. Delamination.
  - 4. Backing deterioration

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. All products used for flooring installation shall comply with flammability and smoke classifications for various locations of installation. Comply with applicable requirements of California Building Code (CBC) Chapter 8.
- B. Flooring surface shall be stable, firm, and slip resistant. CBC Section 11B-302.1 General.

- C. All products used for flooring installation shall comply with flammability and smoke classifications for various locations of installation. Comply with applicable requirements of California Building Code (CBC) Chapter 8.
  - 1. Smoke Density: ASTM E662 Rating to be less than 450 Dm (Optical Density) in flaming mode. (CBC 804.4.1).
- D. Provide glue-down installation conforming to CBC Section 11B-302.2.
  - 1. Carpet shall be securely attached and shall have a firm cushion. pad, or backing or no cushion or pad.
    - a. Carpet shall have level loop, textured loop, level cut or level cut/uncut pile texture.
    - b. Pile height shall be 1/2 inch maximum.
  - 2. Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length.
    - a. Carpet edges shall comply with CBC Section 11B-303.
- E. Comply with CalGreen Building Standards: All installed carpeting shall be low VOC emissions listed. Certified as Low Emission by one of the following:
  - 1. Carpet and Rug Institute's Green Label Plus Program. CalGreen 5.504.4.4.1
  - 2. Compliant with the VOC emission limits and testing requirements specified in the California Department of Public Health's "Standard Method for the Testing and Evaluation Chambers", Version 1.1, February 2010 or Specification 01350. CalGreen 5.504.4.4.2.
  - 3. NSF/ANSI 140 at Gold level or higher. CalGreen 5.504.4.4.3
  - 4. SCS Floorscore; [www.scs-certified.com](http://www.scs-certified.com). CalGreen 5.504.4.4.4.
  - 5. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database; [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm). CalGreen 5.504.4.4.5.

## **2.02 CARPET**

- A. Carpet:
  - 1. Product: As indicated on Drawings manufactured by Shaw.
  - 2. Roll Width: 12 ft.
  - 3. Color: As indicated on Drawings.
  - 4. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
  - 5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  - 6. VOC Content: Comply with Section 01 61 16.

## **2.03 CUSHION**

- A. Cushion: Double bond rubber carpet pad.
  - 1. VOC Content: Comply with Section 01 61 16 and CalGreen 5.504.4.4.1.
  - 2. Nominal Thickness: 0.100 inch.

3. Roll Width: 72 inches.
4. Density: 32 lb/cu ft.

## **2.04 ACCESSORIES**

- A. Sub-Floor Filler: White premix latex; Type recommended by carpet manufacturer.
- B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.
- C. Resilient Base: See Section 09 65 00 - Resilient Flooring.
- D. Moldings and Edge Strips: Vinyl, color as selected.
- E. Adhesives:
  1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 61 16.
- F. Seam Adhesive: Recommended by carpet manufacturer.
- G. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.
  1. Peel and stick or a low VOC adhesive application is required

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
  1. Maximum variation of 1/4-inch in 10 ft
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with Section 09 05 61.
  2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- D. Carpet Verification: Verify carpet match before cutting to ensure minimal variation between dye lots.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Remove existing carpet and carpet cushion.
- B. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out carpet and locate seams in accordance with shop drawings.
  - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
    - a. Fit seams straight, not crowded or peaked, free of gaps. Avoid seams in front of doors or other high traffic areas. Join seams by hot adhesive tape method. Form seams straight, not overlapped or peaked, and free of gaps.
  - 2. Do not locate seams perpendicular through door openings.
  - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
  - 4. Locate change of color or pattern between rooms under door centerline.
  - 5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.
  - 1. Join seams by hot adhesive tape method. Form seams straight, not overlapped or peaked, and free of gaps.

#### **3.04 STRETCHED-IN CARPET**

- A. Install tackless strips with pins facing the wall around entire perimeter, except across door openings. Use edge strip where carpet terminates at other floor coverings.
- B. Space tackless strips slightly less than carpet thickness away from vertical surfaces, but not more than 3/8 inch.
- C. Install cushion in maximum size pieces using spot adhesive to adhere to subfloor.
- D. Lay out cushion so that seams will be perpendicular to, or offset from, minimum 6 inches from carpet seams.
- E. Butt cushion edges together and tape seams.
- F. Trim cushion tight to edge of tackless strip and around projections and contours.
- G. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.
- H. Join seams by hand sewing. Form seams straight, not overlapped or peaked, and free of gaps.
- I. Following seaming, hook carpet onto tackless strip at one edge, power stretch, and hook firmly at other edges. Follow manufacturer's recommendations for method and amount of stretch.
- J. Trim carpet neatly at walls and around interruptions. Tuck edges into space between tackless strip and wall.
- K. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

#### **3.05 DIRECT-GLUED CARPET**

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
  - 1. Butt and glue edges tightly and roll seams to ensure complete bond.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.
  - 1. Edges: Run carpet under open bottom items and all cabinets and install tight to walls. Neatly trim and secure edge of carpet adjacent to door jambs where no base occurs.
- F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.
- G. Carpet Finishing: Brush all seams and trim protruding pile tufts level. Remove excess adhesive on the carpet surface and thoroughly vacuum entire area. Leave room clean and ready for use.

### **3.06 PROTECTION**

- A. Cover carpet during construction period with reinforced kraft paper when construction traffic is required to cross carpeted areas.
- B. Remove and replace damaged or improperly installed carpet.

### **3.07 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove excess adhesive from floor and wall surfaces without damage.
- C. Clean and vacuum carpet surfaces.
  - 1. Vacuum and remove all stains from carpet to satisfaction of Owner and in accordance with cleaning specified in Section 01 70 00 - Execution and Closeout Requirements.

## **END OF SECTION**

## **SECTION 09 72 00 WALL COVERINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface preparation and prime painting.
- B. Wall covering. VWC-1
  - 1. Digital Print Wall Covering. VWC-2

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit six samples of wall covering, 6 by 9 inch in size illustrating color, finish, and texture.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
- H. Installer's Qualification Statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.
  - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

#### **1.06 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide panel, 3 panel drops wide, full height, illustrating installed wall covering and joint seaming technique.
- C. Locate where directed.
- D. Mock-up may not remain as part of the Work.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

#### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

### **PART 2 PRODUCTS**

#### **2.01 WALL COVERINGS**

- A. General Requirements:
  - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
  - 2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
- B. Wall Covering: Fabric-backed vinyl roll stock.
  - 1. Comply with ASTM F793/F793M, Category V, Type II.
  - 2. Backing: Woven, osnaburg fabric.
  - 3. Color: As indicated on Drawings.
  - 4. Overcoating: Manufacturer's standard coating for stain resistance.
  - 5. Manufacturers:
    - a. Koroseal/RJF International: [www.koroseal.com](http://www.koroseal.com).
    - b. MDC Wallcoverings: [www.mdcwall.com](http://www.mdcwall.com).
    - c. Wolf-Gordon: [www.wolfgordon.com](http://www.wolfgordon.com).
    - d. Versa Wallcovering: [www.versawallcovering.com](http://www.versawallcovering.com)

- e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Digital Print Wall Covering: Fabric-backed vinyl roll stock.
  - 1. Basis of Design Product: Koroseal Digital Type II Vinyl as manufactured by Koroseal/RJF International, or approved equal.
    - a. Local Representative: Scott Hewlett, (310) 633-1506.
  - 2. Conform to ASTM F793/F793M, Category V, Type II.
    - a. Comply with Federal Specification CCC-W408A and the CFFA-W-101-D, Quality Standard for Vinyl Coated Fabric Wallcovering
    - b. Mildew Inhibitors: Yes.
  - 3. General: Graphic film and overlamine for inkjet printing with solvent, UV, latex inks and screen printing. For field applied application.
  - 4. Graphics: Artwork provided by Owner.
  - 5. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
  - 6. Backing: Non-woven, synthetic fabric.
  - 7. Overcoating: Manufacturer's standard coating for, factory applied 0.37 thick "Protected Film".
  - 8. Manufacturers:
    - a. Koroseal/RJF International; Koroseal Digital Type II Vinyl: [www.koroseal.com](http://www.koroseal.com).
    - b. MDC Wallcoverings: [www.mdcwall.com](http://www.mdcwall.com).
    - c. Wolf-Gordon: [www.wolfgordon.com](http://www.wolfgordon.com).
    - d. Versa Wallcovering: [www.versawallcovering.com](http://www.versawallcovering.com)
    - e. 3M Company - Commercial Solutions Division (CSD); Vinyl Graphic Wall Coverings: [https://www.3m.com/3M/en\\_US/company-us/search/?Ntt=Vinyl+Graphic+Wall+Coverings](https://www.3m.com/3M/en_US/company-us/search/?Ntt=Vinyl+Graphic+Wall+Coverings) .
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
- E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- F. Substrate Primer and Sealer: Alkyd enamel type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.



- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.
- D. Inspect for any conditions detrimental to the proper and timely completion of the installation. Do not proceed with work until conditions have been corrected.

### **3.02 PREPARATION**

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
  - 1. Provide hanging surface that is smooth and free of all excess dust, oils or other foreign matter.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.
- E. Marks: Seal with shellac those that may bleed through surface finishes.
- F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- G. Vacuum clean surfaces free of loose particles.

### **3.03 INSTALLATION**

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Use wall covering in roll number sequence.
- D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Horizontal seams are not acceptable.
- G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- I. Do not install wall covering more than 1/4 inch below top of resilient base.
- J. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- K. Apply wall covering to electrical, telephone, and communications wall plates prior to replacing.
- L. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.
- M. Install termination trim.
- N. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide manufacturer's field representative to observe continuing installation.
- C. After the application of three sheets of wood wallcovering, request inspection by Architect for material quality and proper installation.

#### **3.05 CLEANING**

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

#### **3.06 PROTECTION**

- A. Do not permit construction activities at or near finished wall covering areas.

#### **3.07 MAINTENANCE**

- A. Submit a copy of maintenance instructions to District.

**END OF SECTION**

**SECTION 09 72 60**  
**RESILIENT TACKABLE WALL COVERING**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES:**

- A. Resilient cork/linoleum tackable wall covering. TWP-2
- B. Surface preparation and prime painting.
- C. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 91 23 - Interior Painting: Preparation and priming of substrate surfaces.
- C. Section 09 72 00 - Wall Coverings: Fabric wall coverings for adhesive application to solid wall surfaces.
- D. Section 10 11 00 - Visual Display Units: Prefabricated, framed tackboards and markerboards.

**1.03 REFERENCE STANDARDS**

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering.
- D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, 7 x 9 inch in size illustrating color, finish, and texture of each type of tackable wallcovering material required.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
  - 1. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.

### **1.05 QUALITY ASSURANCE**

- A. Single Source Responsibility: Obtain tackable wallcovering system components from a single source.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

### **1.06 MOCK-UPS**

- A. Prepare mock-ups for architect's review and to establish requirements for seaming and finish trim.
  - 1. Correct areas, modify method of application/installation, or adjust finish texture as directed by architect to comply with specified requirements.
  - 2. Maintain mock-ups accessible to serve as a standard of quality.
  - 3. Install sample panel of each type of wallcovering specified.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in original factory packaging, labeled with manufacturer, brand name, size, color, and lot number.
- B. Inspect roll materials at arrival on site, to verify acceptability.
- C. Store materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, and extreme temperatures.
- D. Protect packaged adhesive from temperature cycling and cold temperatures.
- E. Do not store roll goods on end.
- F. Maintain room temperature within the storage area at not less than 68 degrees Fahrenheit (20 degrees Celsius) during the period materials are stored

### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
  - 1. Maintain ambient temperature within the building at not less than 68 degrees Fahrenheit (20 degrees Celsius) for a minimum of seventy-two hours prior to beginning of installation.
    - a. Do not install tackable wallcovering until the space is enclosed and weatherproof.
    - b. Do not install tackable wallcovering until temperature is stabilized and permanent lighting is in place.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

## **1.09 WARRANTY**

- A. Submit manufacturer's limited five-year written warranty against manufacturing defects.-

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURER**

- A. Basis of Design Product: Bulletin Board Coirk Colored as manufactured by Wolf Gordon, or approved equal.
- B. Other Acceptable Manufacturers:
  - 1. Forbo Flooring Systems; Bulletin Board: [www.forboflooringna.com](http://www.forboflooringna.com).
  - 2. Koroseal/RJF International; Walltalkers, Tac-Wall: [www.koroseal.com](http://www.koroseal.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 PRODUCTS**

- A. Product Description:
  - 1. Material: Homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing.
- B. Roll Width: 48 inch.
- C. Thickness (Gauge): 1/4 inch.
- D. Roll Length: Approximately  $\pm$  90-95 lineal foot rolls.
- E. Flexibility: Flexible enough to bend around a 2-3/4 inch radius.
- F. Color to extend through thickness of material.
  - 1. Color: To be selected by Architect from full range.
- G. Mounting: Adhesive.
- H. Performance:
  - 1. Comply with ASTM F2034.
  - 2. Surface Burning Characteristics Classification: Provide materials that meet classification ratings below:
    - a. ASTM E84 / NFPA 255: Class II/B
  - 3. Thermal Conductivity: Coefficient of thermal conductivity is  $\pm$  0.10 W/m-K.
  - 4. Sound Testing:
    - a. Noise Reduction Coefficient (NRC) ASTM C423: 0.10.
    - b. Sound Absorption Average (SAA) ASTM C423: 0.09.
  - 5. Resistance to Bacteria: Independent testing has shown that a sterile zone around the material inhibits the growth of organisms such as staphylococcus aureas and Clostridium difficile.
  - 6. Anti-Static Properties: Naturally anti-static.
  - 7. Dimensional Stability: Resist cracking, drying, and peeling.

## **2.03 ACCESSORIES**

- A. Adhesive: Solvent-free, SBR type linoleum adhesive or polyvinyl acetate dispersion type (contact adhesive) when used in a press.
- B. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- C. Substrate Primer and Sealer: Alkyd enamel type.
- D. Color matched caulk:
  - 1. To be selected by Architect from full range.
- E. Joints:
  - 1. Butt joint.
- F. Termination Trim: Extruded plastic, clear.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and conditions in which tackable wallcoverings will be installed.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.
- D. Complete finishing operations, including painting, before beginning installation of tackable wallcovering materials.
  - 1. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
  - 2. Wall surfaces to receive wallcovering materials shall be dry and free from dirt, grease, loose paint, and scale.
  - 3. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.
  - 4. Beginning of installation means acceptance of surface conditions.

### **3.02 PREPARATION**

- A. Surface Preparation: Remove hardware, accessories, plates, and similar items to allow tackable wallcovering to be installed.
- B. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.
  - 1. Plaster surface: Remove surface chalk. In new work, use moisture meter to determine moisture content. Do not begin installation when moisture content is greater than five percent.
  - 2. Gypsum board surface: Recess nails and screws. Repair irregular tape joints, sand and remove dust.

3. Painted surface: Remove loose paint or scale. Sand surface of enamel or gloss paint and wipe clean with damp cloth.
  - a. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
  - b. Ensure wall surfaces scheduled to receive tackable wallcovering are properly sealed with a quality primer specified for use under flexible vinyl wallcoverings.
  - c. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- D. Vacuum clean surfaces free of loose particles.
- E. Permanent HVAC system should be set to 68 degrees Fahrenheit (20 degrees Celsius) for at least seventy-two hours prior to, during, and after the installation.

### **3.03 INSTALLATION**

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering. Let contact adhesive set tack free.
  1. Apply adhesive with a 1/16 inch square notch trowel to the area to receiving the sheet (apply enough for one sheet at a time).
- C. Use wall covering in roll number sequence.
- D. Cut sheets to size including a few inches of overage. Allow sheets to lay flat for at least twenty-four hours prior to the application. Mark roll direction and sequence on the backside of each sheet. Hang sheets in sequence as cut from the roll, do not reverse sheets.
  1. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- E. Back roll each sheet prior to the installation to release curl memory.
- F. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tightly.
  1. Work from top to bottom then side to side. Roll sheet firmly into adhesive for positive contact and to remove air bubbles.
- G. Horizontal seams are not acceptable.
  1. For seamed applications, using a seam and strip cutter remove the factory edge of one sheet. Using the same tool, overlap and trace cut the mating edge of the second sheet. Repeat this step for as many sheets as required for the job.
  2. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- H. Scribe, cut, and fit material to butt tightly to adjacent surfaces, built-in casework, and permanent fixtures and pipes.
  1. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- I. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- J. Install termination trim.
- K. Remove adhesive residue immediately after each panel is hung with a mild soap/water solution and a soft cloth/sponge.

### **3.04 CLEANING**

- A. Clean wallcovering using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners. Rinse thoroughly with water and let dry before using.
- B. It is important to remove adhesive while wet.

### **3.05 PROTECTION**

- A. Protect installed product and finish surfaces from damage during construction.

**END OF SECTION**



**SECTION 09 78 00**  
**INTERIOR WALL PANELING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Framed Decorative Panel System. WP-1

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.
- C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
  - 1. Scale of Drawing Elevations: 1/4 inch to 1 foot, minimum.
  - 2. Scale of Drawing Details: 1-1/2 inches to 1 foot, minimum.
- D. Samples: Submit two samples 12 by 12 inches in size, indicating finish, surface design, and color for each type of panels; \_\_\_\_\_.
- E. Samples: Submit two 12-inch long frames; finish as specified.
- F. Certificates: Certify that products of this section meet or exceed specified requirements.
- G. Manufacturer's Instructions: Provide manufacturer's installation instructions.
- H. Manufacturer's qualification statement.
- I. Installer's qualification statement.
- J. Maintenance Data: Include recommended instructions, methods, and materials for cleaning glass, aluminum framing, and FRP panels.
- K. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
- L. Specimen Warranty: Manufacturer warranty.
- M. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.
- B. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least three years of documented experience.

### **1.05 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct one mock-up, 8 feet high by 8 feet wide of wall paneling of each type, illustrating joints and trim.
- C. Locate where directed.
- D. Mock-ups may remain as part of the work.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
- B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.
- C. Packaging Waste Management: See Section 01 74 19.

### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Extended Correction Period: Correct defective work within a 5-year period for \_\_\_\_\_ commencing on the Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Framed Decorative Panel System:
  - 1. Basis of Design Product: Sieva Large Panel Wall System as manufactured by Marlite, or approved equal.
  - 2. Marlite, Inc: [www.marlite.com/#sle](http://www.marlite.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 REGULATORY REQUIREMENTS**

- A. Surface Burning Classification: Provide wall paneling assemblies meeting Class A when tested in accordance with ASTM E84.

### **2.03 FRAMED DECORATIVE PANEL SYSTEM**

- A. Description: Decorative pre-finished panel with pre-engineered hardware trim system. Mounting of panels is to be executed with adhesive and no exposed fasteners.
  - 1. High-Pressure Laminate (HPL) on fiber board substrate panels.
  - 2. Hardware.
- B. Performance Requirements:
  - 1. Burn Characteristics to ASTM E84, Class A.
    - a. Flame spread: 0-25.
    - b. Smoke Developed 0-450.

C. Hardware (Trim):

1. Panel (Reveal) Trim: Aluminum profiles in 8' lengths.
  - a. Reveal:
    - 1) Horizontal: LP551 Slim Reveal 1/16 inch.
    - 2) Vertical: LP551 Slim Reveal 1/16 inch.
  - b. Edge and Inside Corner: LP570 Edge Cap ½ inch and LP580-A Edge Receiver and LP580-B Edge Batten ½ inch.
  - c. Outside Corner: LP560 Outside Corner ½ inch face elements.
2. Hardware and Trim Material:
  - a. Aluminum - Heavy weight extruded aluminum 6063-T5 alloy and factory pre-finished.
  - b. Exposed aluminum: [Clear satin anodized] [Black satin anodized].

D. Panels:

1. Panel Face Dimensions: Nominal as indicated.
2. Panel Thickness: Nominal ½ inch.
3. Wood Fiber Substrate (backerboard): Medium density wood fiberboard, 1/2 inch, conforming to ANSI A208.2, industrial-grade MDF or other wood fiber substrates 75 % minimum recycled wood waste and having no added formaldehyde.
4. High Pressure Laminate Panels: Vertical grade high pressure plastic laminate adhered to wood fiber substrate.
  - a. Edges: Square cut. Panels require field kerf cut for use with LP551 Slim Reveal 1/16-inch Trim. Panels require field dado cut for use with LP552 Narrow Reveal ¼-inch Trim.
  - b. Balancing Backer: Kraft paper that does not contribute to or pose additional fire hazard.
  - c. Color and pattern: As selected by Architect from manufacturer's standard range.

E. Accessories:

1. Adhesives: Solvent based low VOC adhesive.
  - a. Acceptable Material: Marlite C-109 Solvent Based Adhesive.

F. Fabrication:

1. Ensure framing panels, hardware and accessories are factory finished and ready to install except for field fabrication as required at work site and perimeter conditions.
  - a. Refinish field cut panel edges in accordance with manufacturer's instruction before installation.
  - b. Drill corners for cut-outs 1/8-inch radius minimum.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces for adhered items are clean and smooth.
  - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.
- B. Start of installation constitutes acceptance of project conditions.

### **3.02 INSTALLATION**

- A. Install panels in accordance with manufacturer's instructions.
- B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.
- C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
- D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
- E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
- F. Install trim with adhesive.
- G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.
- H. Remove excess sealant after paneling is installed and prior to curing.

### **3.03 ADJUSTING**

- A. Replace paneling installed out of plumb and/or not aligned with adjacent panels or construction.

### **3.04 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

### **3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

### **3.06 PROTECTION**

- A. Protect installed interior wall paneling from subsequent construction operations.

**END OF SECTION**

**SECTION 09 84 30**  
**SOUND-ABSORBING WALL AND CEILING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sound-absorbing panels. AWP-1, AWP-2, AWP-3, & AWP-4.
- B. Mounting accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting.

**1.03 REFERENCE STANDARDS**

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout and fabric orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
- E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
- F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.
- G. Manufacturer's qualification statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

## **1.07 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for additional mock-up requirements.
- B. Construct mock-up of acoustical units at location as indicated by Architect.
  - 1. Minimum mock-up dimensions; 96 by 96 inches.
  - 2. Mock-up may remain as part of work.

## **PART 2 PRODUCTS**

### **2.01 FABRIC-COVERED SOUND-ABSORBING UNITS**

- A. General:
  - 1. Prefinished, factory assembled fabric-covered panels.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Fabric-Covered Acoustical Panels for Walls:
  - 1. Standard Basis of Design Product: Indicated on drawings as manufactured by Autex Global, or approved equal.
  - 2. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
    - a. Facing: 1/16 inch impact-resistant and tackable surface laminated to core.
  - 3. Core Density: 6 to \_\_\_\_ lb/cu ft.
  - 4. Sound Absorption: Noise Reduction Coefficient (NRC) of 0.80 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
  - 5. Panel Size: 24 inches by 48 inches.
  - 6. Panel Thickness: As required to meet required acoustical performance.
  - 7. Edges: Perimeter edges reinforced by a formulated resin hardener.
  - 8. Corners: As detailed.
  - 9. Fabric: Woven polyester.
  - 10. Color: As indicated on Drawings.
  - 11. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
  - 12. Mounting Method: Back-mounted with mechanical fasteners.

### **2.02 FABRICATION**

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
  - 1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.

2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.
  - C. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

## **2.03 ACCESSORIES**

- A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
  1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.
  2. Z-clip hanger and magnet system with magnets recessed into panel frame and designed to engage steel mounting plates secured to substrate with screws.
- B. Fixing Clips: Manufacturers standard for application as indicated.
- C. Furring Strips: 1 by 2 inch wood furring.
- D. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install mounting accessories and supports in accordance with shop drawings.
- C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- D. Furring-Mounted Cementitious Wood Fiber Panels:
  1. Lay out panels vertically, with factory edges butted tight, ends occurring over firm bearing, and cut edges facing away from factory edges; attach Z-furring strips horizontally; start with J-channel furring 6 inches above finished floor, and provide 1 inch clearance along length of strip from ceiling, unless otherwise indicated.
  2. Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 24 inches on center, maximum.
  3. Install acoustic insulation between furring as indicated on drawings.
  4. Adhere first panel from edge to furring strip; attach subsequent panels using fasteners.
- E. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
  1. Plumb and level.

2. Flatness.
3. Width of joints.

### **3.03 CLEANING**

- A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

### **3.04 PROTECTION**

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

**END OF SECTION**



## **SECTION 09 91 13 EXTERIOR PAINTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Materials for backpriming woodwork.
- D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Exposed surfaces of steel lintels and ledge angles.
  - 2. Mechanical and Electrical:
    - a. On the roof and outdoors, paint equipment exposed to weather or to view, including factory-finished materials.
- E. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Non-metallic roofing and flashing.
  - 6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
  - 7. Floors, unless specifically indicated.
  - 8. Glass.
  - 9. Concealed pipes, ducts, and conduits.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 50 00 - Metal Fabrications: Shop-primed items.

#### **1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

#### **1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- E. SCAQMD 1113 - Architectural Coatings.
- F. SSPC-SP 1 - Solvent Cleaning.
- G. SSPC-SP 2 - Hand Tool Cleaning.
- H. SSPC-SP 6 - Commercial Blast Cleaning.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
  - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years documented experience, approved by manufacturer, and with minimum three years documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

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

#### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
  - 1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
    - a. Local representative Joe Esquer, 657.212.0111.
  - 2. Dunn-Edwards Corporation: [www.dunnedwards.com](http://www.dunnedwards.com),
    - a. Local representative Wanda Barragan 909.261.1289.
  - 3. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
    - a. Local representative Susan L. Giampietro 949.410.2452.
  - 4. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - a. Local representative John Dumesnil 619.665.9341.

- b. Local representative Rocky Berlanga 657.269.0922.
- 5. Vista Paint Corporation: [www.vistapaint.com/#sle](http://www.vistapaint.com/#sle).
  - a. Local representative Mark Brower 323.397.9000.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. No intentionally added cadmium.
- C. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.
- D. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
    - d. Architectural coatings VOC limits of California.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- E. Flammability: Comply with applicable code for surface burning characteristics.
- F. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- G. Colors: As indicated in Color Schedule.
  - 1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

## **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including cement board, primed wood, and primed metal.
  - 1. One or two coats to cover and one coat primer.
  - 2. Top Coat(s): Exterior Latex.
  - 3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen at all locations.
    - b. Semi-Gloss: MPI gloss level 5; use this sheen at trim.
  - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Wood, Opaque, Acrylic Latex, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of acrylic latex enamel.
  - 3. Flat: Two coats of acrylic latex.
- C. Ferrous Metals, Unprimed, Latex, 3 Coat:
  - 1. One coat of latex primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- D. Ferrous Metals, Primed, Latex, 2 Coat:
  - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
  - 2. Semi-gloss: Two coats of latex enamel.
- E. Ferrous Metals, Unprimed, High-Performance, 3 Coat:
  - 1. Pre-Treatment: As recommended by manufacturer
  - 2. One coat galvanize primer.
  - 3. Gloss: Two coats of alkyd enamel.

## **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Alkali Resistant Water Based Primer.
  - 2. Anti-Corrosive Alkyd Primer for Metal.
  - 3. Interior/Exterior Quick Dry Alkyd Primer for Metal.
  - 4. Alkyd Primer for Galvanized Metal.
  - 5. Water Based Primer for Galvanized Metal.
  - 6. Rust-Inhibitive Water Based Primer.
  - 7. Interior/Exterior Quick Dry Primer for Aluminum.
  - 8. Stain Blocking Primer.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. 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. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  - 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

- I. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. Sand metal surfaces lightly between coats to achieve required finish.
- I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

### **3.05 CLEANING**

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

### **3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

## **SECTION 09 91 23 INTERIOR PAINTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Materials for backpriming woodwork.
- D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Prime surfaces to receive wall coverings.
  - 3. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
- E. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Floors, unless specifically indicated.
  - 6. Glass.
  - 7. Concealed pipes, ducts, and conduits.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

#### **1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

#### **1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.



- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- F. SCAQMD 1113 - Architectural Coatings.
- G. SSPC-SP 1 - Solvent Cleaning.
- H. SSPC-SP 2 - Hand Tool Cleaning.
- I. SSPC-SP 6 - Commercial Blast Cleaning.
- J. SSPC-SP 13 - Surface Preparation of Concrete.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
  - 4. Manufacturer's installation instructions.
  - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

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

### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
  - 1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
    - a. Local representative Joe Esquer, 657.212.0111.
  - 2. Dunn-Edwards Corporation: [www.dunnedwards.com](http://www.dunnedwards.com),
    - a. Local representative Wanda Barragan 909.261.1289.
  - 3. Pittsburgh Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
    - a. Local representative Susan L. Giampietro 949.410.2452.

4. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - a. Local representative John Dumesnil 619.665.9341.
  - b. Local representative Rocky Berlanga 657.269.0922.
5. Vista Paint Corporation: [www.vistapaint.com/#sle](http://www.vistapaint.com/#sle).
  - a. Local representative Mark Brower 323.397.9000.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  4. Supply each paint material in quantity required to complete entire project's work from a single production run.
  5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. No intentionally added cadmium.
- C. Volatile Organic Compound (VOC) Content:
  1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
    - d. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; [www.otcair.org](http://www.otcair.org); specifically:
      - 1) Opaque, Flat: 50 g/L, maximum.
      - 2) Opaque, Nonflat: 150 g/L, maximum.
      - 3) Opaque, High Gloss: 250 g/L, maximum.
    - e. Architectural coatings VOC limits of California.
  2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Flammability: Comply with applicable code for surface burning characteristics.

- E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- F. Colors: As indicated on drawings.
  - 1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  - 2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

## **2.03 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Interior Latex.
  - 3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Eggshell: MPI gloss level 3; use this sheen at all locations.
    - c. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  - 1. Medium duty applications include doors, door frames, railings, handrails, and guardrails.
  - 2. Two top coats and one coat primer.
  - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Medium Duty Vertical and Overhead: Including gypsum board, concrete, uncoated steel, shop primed steel, galvanized steel, and aluminum.
  - 1. Two top coats and one coat primer.
  - 2. Studio Walls: Water-based, acrylic theatrical primer & sealant.
    - a. Egg-Shell: Two Coats of Tough-Prime by Rosco Laboratories or approved equal product.
    - b. Color: No. 5711 Chroma Key Green.
- D. Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
  - 1. Shop primer by others.
  - 2. One top coat.
  - 3. Top Coat: Latex Dry Fall.
- E. Ferrous Metals, Unprimed, Latex, 3 Coat:
  - 1. One coat of latex primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- F. Ferrous Metals, Primed, Latex, 2 Coat:
  - 1. Touch-up with latex primer.

2. Semi-gloss: Two coats of latex enamel.
- G. Galvanized Metals, Latex, 3 Coat:
  1. One coat galvanize primer.
  2. Semi-gloss: Two coats of latex enamel.

## **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  1. Interior Institutional Low Odor/VOC Primer Sealer.
  2. Interior/Exterior Latex Block Filler.
  3. Interior Latex Primer Sealer.
  4. Interior Drywall Primer Sealer.
  5. Anti-Corrosive Alkyd Primer for Metal.
  6. Interior Rust-Inhibitive Water Based Primer.
  7. Interior Water Based Primer for Galvanized Metal.
  8. Interior Alkyd Enamel Undercoat.
  9. Stain Blocking Primer.
  10. Stain Blocking Primer, Water Based.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  1. Gypsum Wallboard: 12 percent.
  2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
  - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  - 2. Prepare surface according to SSPC-SP 2.
- I. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.
- J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- K. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

#### **3.05 CLEANING**

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

#### **3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

### **END OF SECTION**

**SECTION 09 93 00**  
**STAINING AND TRANSPARENT FINISHING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Field application of stains.
- B. Field application of transparent finishes.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 91 13 - Exterior Painting: Stains and transparent finishes for concrete substrates.
- C. Section 09 91 23 - Interior Painting: Stains and transparent finishes for concrete substrates.

**1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- F. SCAQMD 1113 - Architectural Coatings.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and catalog number, and general product category.
  - 2. Manufacturer's installation instructions.
- C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 8 by 8 inch in size.
- D. Certification: By manufacturer that stains and transparent finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Manufacturer's Qualification Statement.



- G. Applicator's Qualification Statement.
- H. Maintenance Data: Submit data including finish schedule showing where each product, color, and finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements for additional provisions.
  - 2. Extra Stock Materials: Stain and transparent finish materials, 1 gal of each color and type; store where directed.
  - 3. Label each container with color and type in addition to the manufacturer's label.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

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

#### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Transparent Finishes:
1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  2. Bona US: [www.bona.com/#sle](http://www.bona.com/#sle).
  3. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  4. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Stains:
1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  2. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  4. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 STAINS AND TRANSPARENT FINISHES - GENERAL**

- A. Finishes:
1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Provide materials compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  3. Supply each finish material in quantity required to complete entire project's work from a single production run.
  4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. No intentionally added cadmium.
- C. Volatile Organic Compound (VOC) Content:
1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
    - d. Architectural coatings VOC limits of California.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Flammability: Comply with applicable code for surface burning characteristics.
- E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- F. Colors: To be selected from manufacturer's full range of available colors.
  1. Selection to be made by Architect after award of contract.
  2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

## **2.03 EXTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS**

- A. Finish on Wood - Trim:
  1. Stain: Exterior Solid Stain for Wood, Water Based.
    - a. Products:
      - 1) Behr Premium Solid Color Waterproofing Stain No.5011 Tintable White (MPI #16).
      - 2) Pittsburgh Paints Flood Pro Series Solid Color Stain, FLD820 Series. (MPI #16)
      - 3) Sherwin-Williams WoodScapes Acrylic Solid Color Stain. (MPI #16)
      - 4) Wolman by Rust-Oleum Corporation DuraStain One Coat Solid Color Stain: [www.rustoleum.com/#sle](http://www.rustoleum.com/#sle). (MPI #16)
      - 5) Substitutions: Section 01 60 00 - Product Requirements.
  2. Stain: Exterior Semi-Transparent Stain for Wood, Water Based.
    - a. Products:
      - 1) Behr Premium Semi-Transparent Waterproofing Stain No.5077 Tint Base.
      - 2) Pittsburgh Paints ProLuxe SRD Semi-Transparent Wood Finish, SIK500-190, Matte. (MPI #156)
      - 3) Sherwin-Williams WoodScapes Polyurethane Semi-Transparent Stain.
      - 4) Wolman by Rust-Oleum Corporation DuraStain One Coat Semi-Transparent Stain: [www.rustoleum.com/#sle](http://www.rustoleum.com/#sle).
      - 5) Substitutions: Section 01 60 00 - Product Requirements.
  3. Stain: Exterior Semi-Transparent Stain for Wood Decks, Solvent Based or Water Based.
    - a. Products:
      - 1) Pittsburgh Paints ProLuxe SRD Semi-Transparent Wood Finish, SIK500-190, Matte. (MPI #33)
      - 2) Wolman by Rust-Oleum Corporation F&P Finish and Preservative: [www.rustoleum.com/#sle](http://www.rustoleum.com/#sle). (MPI #33)
      - 3) Substitutions: Section 01 60 00 - Product Requirements.
  4. Top Coat(s): Exterior Clear Water Based Varnish with UV Inhibitor.
    - a. Products:

- 1) Pittsburgh Paints Deft Interior/Exterior Water-Based Polyurethane, DFT259, Satin.
  - 2) Pittsburgh Paints Deft Interior/Exterior Water-Based Polyurethane, DFT258, Semi-Gloss
  - 3) Pittsburgh Paints Deft Interior/Exterior Water-Based Polyurethane, DFT257, Gloss.
  - 4) United Gilsonite Laboratories ZAR Exterior Water Base High Performance: [www.zar.com/#sle](http://www.zar.com/#sle).
  - 5) Substitutions: Section 01 60 00 - Product Requirements.
5. Top Coat Sheen:
- a. Satin: MPI gloss level 4; use this sheen at all locations.
  - b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
  - c. Gloss: MPI gloss level 6; use this sheen at all locations.
  - d. High Gloss: MPI gloss level 7; use this sheen at all locations.

## **2.04 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS**

- A. Finish on Wood - Trim:
1. One-coat varnish over two-coat stain.
  2. Stain: Semi-transparent stain for wood, water based; MPI #186.
    - a. Products:
      - 1) Behr Fast Drying Water-Based Wood Stain [B4500].
  3. Stain: Semi-transparent stain for wood, water based with polyurethane.
    - a. Products:
      - 1) Behr Water-Based Wood Stain and Poly in One, Satin [B6200].
      - 2) Behr Water-Based Wood Stain and Poly in One, Gloss [B6300].
      - 3) Substitutions: Section 01 60 00 - Product Requirements.
  4. Sealer: Water based, sanding sealer, clear.
  5. Top Coat: Clear water-based varnish.
    - a. Products:
      - 1) Behr Fast Drying Water-Based Polyurethane [B8100].
      - 2) Pittsburgh Paints Deft Interior/Exterior Water-Based Polyurethane, DFT259, Satin.
      - 3) Pittsburgh Paints Deft Interior/Exterior Water-Based Polyurethane, DFT 258, Semi-Gloss.
      - 4) Pittsburgh Paints Deft Interior/Exterior Water-Based Polyurethane, DFT257, Gloss. (MPI #129)
      - 5) Rodda Waterborne Alkyd Urethane Varnish, 593 Series, (MPI #128, 129, 130)
      - 6) Substitutions: Section 01 60 00 - Product Requirements.
  6. Top Coat Sheen:

- a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- b. Gloss: MPI gloss level 6; use this sheen at all locations.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of stains and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- 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. Wood: 15 percent, measured in accordance with ASTM D4442.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- G. Reinstall items removed prior to finishing.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for general requirements for field inspection.
- B. Owner will provide field inspection.

#### **3.05 CLEANING**

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

#### **3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

**SECTION 09 96 00**  
**HIGH-PERFORMANCE COATINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. High performance coatings.
  - 1. Exterior Steel: AESS, exterior steel, metal canopies, exposed steel decks, hollow metal doors and frames, metal stair stringers and treads, guardrails/handrails, metal copings/flashings (not prefinished), and equipment screens,
  - 2. Epoxy on trash enclosure walls.
- B. Surface preparation.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 91 13 - Exterior Painting.
- C. Section 09 91 23 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.
- D. Section 09 67 00 - Fluid-Applied Flooring: High performance fluid-applied flooring systems.

**1.03 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D2486 - Standard Test Methods for Scrub Resistance of Wall Paints.
- C. ASTM D4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
- D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.
- F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- G. SCAQMD 1113 - Architectural Coatings.
- H. SSPC-SP 1 - Solvent Cleaning.
- I. SSPC-SP 2 - Hand Tool Cleaning.
- J. SSPC-SP 6 - Commercial Blast Cleaning.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

1. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review the following:
  - a. Environmental requirements.
  - b. Protection of surfaces not scheduled to be coated.
  - c. Surface preparation.
  - d. Application.
  - e. Repair.
  - f. Field quality control.
  - g. Cleaning.
  - h. Protection of coating systems.
  - i. One-year inspection.
  - j. Coordination with other work.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
  1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  2. MPI product number (e.g. MPI #47).
  3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
  4. Manufacturer's installation instructions.
  5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
- C. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection.
- D. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Data: Include cleaning procedures and repair and patching techniques.
  1. Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and coated surfaces, and color samples of each color and finish used.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Coating Materials: 1 gallon of each type and color.



3. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

#### **1.06 QUALITY ASSURANCE**

- A. Maintain one copy of each referenced document that applies to application on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

#### **1.07 MOCK-UPS**

- A. See Section 01 40 00 - Quality Requirements for general requirements for mock-ups.
- B. Provide mock-up , 8 feet long by 8 feet wide (or otherwise appropriate), illustrating coating, for each specified coating.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

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

#### **1.09 FIELD CONDITIONS**

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
- F. Restrict traffic from area where coating is being applied or is curing.

#### **1.10 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. High-Performance Coatings:
  - 1. Behr Paint Corp.: [www.behr.com](http://www.behr.com).
  - 2. Carboline: [www.carboline.com](http://www.carboline.com).
  - 3. Dunn Edwards : [www.dunnedwards.com](http://www.dunnedwards.com).
  - 4. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
    - a. Local representative Susan L. Giampietro 949.410.2452.
  - 5. Precision Coatings: [www.precisioncoatingsinc.com/#sle](http://www.precisioncoatingsinc.com/#sle).
  - 6. Sherwin-Williams Company: [www.protective.sherwin-williams.com/industries/#sle](http://www.protective.sherwin-williams.com/industries/#sle).
    - a. Local Representative: John Dumesnil, 619.665.9341.
  - 7. Tnemec Company, Inc: [www.tnemec.com/#sle](http://www.tnemec.com/#sle).
    - a. Local Representative: Tony Hobbs, 310.637.2363.
  - 8. Substitutions: Section 01 60 00 - Product Requirements.

### **2.02 HIGH-PERFORMANCE COATINGS**

- A. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
  - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
  - 2. Lead Content: None.
  - 3. No intentionally added cadmium.
  - 4. Scrubbability: Excellent, when tested in accordance with ASTM D2486.
  - 5. Gloss and Color Retention: Excellent, when tested in accordance with ASTM D4587.

### **2.03 TOP COAT MATERIALS**

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
  - 1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.
  - 2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.

3. Volatile Organic Compound (VOC) Content:
    - a. Provide coatings that comply with the most stringent requirements specified in the following:
      - 1) 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      - 2) SCAQMD 1113 Rule.
      - 3) CARB (SCM).
      - 4) Architectural coatings VOC limits of California.
    - b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
  4. Colors: As indicated.
- B. Urethane Coating:
1. Exterior Steel: AESS, exterior steel, metal canopies, exposed steel decks, hollow metal doors and frames, metal copings/flashings (not prefinished), and equipment screens,
  2. Number of Coats: Two.
  3. Product Characteristics:
    - a. Comply with the performance requirements specified above for moderate exposure.
  4. Top Coat(s): Acrylic Urethane, Water Based, Two-Component.
    - a. Sheen: High Gloss.
    - b. Products:
      - 1) Sherwin-Williams; Pro Industrial Waterbased Acrolon 100: [www.protective.sherwin-williams.com/#sle](http://www.protective.sherwin-williams.com/#sle).
      - 2) Dunn Edwards; Endura-Coat ENCT60: [www.dunnedwards.com](http://www.dunnedwards.com).
      - 3) Benjamin Moore; Ultra Spec HP D.T.M. Acrylic Gloss HP28: [www.benjaminmoore.com](http://www.benjaminmoore.com).
      - 4) Tnemec Company, Inc; Series 1080 Endurashield: [www.tnemec.com/#sle](http://www.tnemec.com/#sle).
      - 5) Substitutions: Section 01 60 00 - Product Requirements.
  5. Primer: As recommended by coating manufacturer for specific substrate.

## 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
  1. Rust-Inhibitive, Water Based; MPI #107.
    - a. Products:
      - 1) Benjamin Moore; Ultra Spec HP Acrylic Metal Primer HP04: [www.benjaminmoore.com](http://www.benjaminmoore.com).
      - 2) Dunn Edwards; EnduraPrime ENPR00: [www.dunnedwards.com](http://www.dunnedwards.com).

- 3) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer:  
[www.protective.sherwin-williams.com/#sle](http://www.protective.sherwin-williams.com/#sle). (MPI #107)
- 4) Tnemec Company, Inc; Series 115 Uni-Bond DF: [www.tnemec.com/#sle](http://www.tnemec.com/#sle).
- 5) Substitutions: Section 01 60 00 - Product Requirements.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- F. Test shop-applied primer for compatibility with subsequent cover materials.
- G. Proceed with coating application only after unacceptable conditions have been corrected.
  1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

### **3.02 PREPARATION**

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Galvanized Surfaces:
  1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  2. Prepare surface according to SSPC-SP 2.
- E. Ferrous Metal:
  1. Solvent clean according to SSPC-SP 1.
  2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.

### **3.03 PRIMING**

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

### **3.04 COATING APPLICATION**

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for general requirements for field inspection.
- B. Owner will provide field inspection.
- C. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

### **3.06 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

### **3.07 PROTECTION**

- A. Protect finished work from damage.

**END OF SECTION**

## **SECTION 10 11 00 VISUAL DISPLAY UNITS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Glass markerboards. GB-1
- B. Tackable wall panels. TWP-1

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

#### **1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling.
- D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
- E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard, tackboard, tackboard surface covering, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- D. Samples: Color charts for selection of color and texture of porcelain enamel steel markerboard, tackboard, tackboard surface covering, and trim.
- E. Test Reports: Show compliance to specified surface burning characteristics requirements.
- F. Manufacturer's printed installation instructions.
- G. Manufacturer's Qualification Statement.
- H. Maintenance Data: Include data on regular cleaning, stain removal .

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

## **PART 2 PRODUCTS**

### **2.01 VISUAL DISPLAY UNITS**

- A. Magnetic Glass Markerboards:
  - 1. Manufacturers:
    - a. Basis of Design Product: View Projection Glass as manufactured by Clarus, or approved equal.
    - b. Claridge Products and Equipment, Inc: [www.claridgeproducts.com/#sle](http://www.claridgeproducts.com/#sle).
    - c. Clarus Glassboards: [www.clarusglassboards.com](http://www.clarusglassboards.com).
    - d. Egan Visual Corporation; Egan Visual GlassBoards: [www.egan.com](http://www.egan.com).
    - e. Forms+Surfaces; [www.vividglass.com](http://www.vividglass.com).
    - f. Glass Whiteboard: [www.glasswhiteboard.com](http://www.glasswhiteboard.com)
    - g. MooreCo, Inc: [www.moorecoinc.com/#sle](http://www.moorecoinc.com/#sle).
    - h. Platinum Visual Systems, Inc.: [pvusa.com](http://pvusa.com).
    - i. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Glass: Laminated, low iron, 1/4 inch thick, with bevel edges and radiused corners, laminated to steel backing sheet for use with magnets. Coated or treated for use as dry erase board or projection surface.
  - 3. Glass Finish: White back-coating.
  - 4. Steel Backing Sheet Thickness: 24 gauge, 0.0239 inch .
  - 5. Size: As indicated on drawings.
  - 6. Frame: No frame, with concealed fasteners.
  - 7. Frame Finish: Anodized, natural.
  - 8. Mounting: Concealed Z clips.
  - 9. Accessories: Provide magnetic marker tray and magnetic marker holder.
- B. Tackable Wall Panels: Fabric laminated to fiberboard; Factory-fabricated. TWP-
  - 1. Manufacturers:
    - a. Basis of Design Product: Indicated on drawings as manufactured by Wolf Gordon, or approved equal.
    - b. A-1 Visual Systems Co.: [www.a-1visualsystems.com](http://www.a-1visualsystems.com).
    - c. ABC School Equipment: [www.abcse.com](http://www.abcse.com).
    - d. ADP Lemco, Inc: [www.adplemco.com/#sle](http://www.adplemco.com/#sle).
    - e. Chatfield-Clarke; Vinyl Tackboard Panels: [www.chafield-clarke.com](http://www.chafield-clarke.com).

- f. Claridge Products and Equipment, Inc; 3400 Series:  
www.claridgeproducts.com/#sle.
  - g. Lamvin Inc.; Tackboard Panels: www.lamvin.com.
  - h. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.
  - i. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Fabric: Vinyl-coated fabric.
- 3. Color, Pattern, and Texture: As selected from manufacturer's full range.
- 4. Backing: Fiber board, 1/2 inch thick, laminated to tack surface.
- 5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- 6. Panel Width: As indicated on drawings.
- 7. Height: Full height of room or wall; No horizontal seams.
- 8. Length: As indicated on drawings.
- 9. Edge Treatment: Square edge unless detailed otherwise.
- 10. Edge Molding: Provide metal "J-mold" type edge trim for exposed edges at door and window openings and similar conditions.
- 11. Adhesives: Provide manufacturer's recommended adhesive, primer, and sealer, produced for use on substrate shown on drawings. Provide materials which are mildew-resistant and non staining to wallcovering.
- C. Combination Units and Units Made of More Than One Panel: Factory-assembled markerboards in a single frame, of materials specified above.
  - 1. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
  - 2. Configuration: As indicated on drawings.
  - 3. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.

## 2.02 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Float Glass: Provide float-glass-based glazing unless otherwise indicated.
  - 1. Fully Tempered Safety Glass: Comply with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
  - 2. Thickness: As indicated.
- C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
  - 1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
  - 2. Ionoplast Interlayer: 0.035 inch thick, minimum.
- D. Vinyl-Coated Fabric: ASTM F793 Category VI.
- E. Fiber Board: ASTM C208, cellulosic fiber board.



- F. Adhesives: Type used by manufacturer.

## **2.03 ACCESSORIES**

- A. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.
- B. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- C. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.
- D. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
- E. Mounting Brackets: Concealed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

### **3.02 PREPARATION**

- A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.
- B. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.03 INSTALLATION**

- A. Install boards in accordance with manufacturer's instructions.
- B. Install with top of marker tray at 30 inches above finished floor.
- C. Secure units level and plumb.
- D. Butt Joints: Install with tight hairline joints.
- E. Carefully cut holes in boards for thermostats, wall switches, and outlets.
- F. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.
  - 1. Fabricate re-wrapped edges where partial panels abut each other, or adjacent surfaces or trim.
  - 2. Re-wrap top, bottom or side edges for cutting panels around door or window openings, abutting trim, protruding objects, and at other openings, including x-cut at receptacles, light switches, and other openings.
    - a. Wrap minimum 2 inches around back of panel.

- b. Carefully cut fiber board, leaving vinyl wallcovering intact. Wrap wallcovering tightly around edge of board and adhere continuously around back of panel with manufacturer's recommended vinyl wallcovering adhesive.

#### **3.04 CLEANING**

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Final Inspection.

**END OF SECTION**

## **SECTION 10 14 19**

### **DIMENSIONAL LETTER SIGNAGE**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Dimensional letter signage.

##### **1.02 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. CBC Chapter 11B - California Building Code-Chapter 11B.

##### **1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Verification Samples: Submit samples showing colors and finishes specified.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- G. Manufacturer's qualification statement.

##### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

##### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

##### **1.06 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Dimensional Letter Signs:
  - 1. Basis of Design Product: Individual Cast Metal Dimensional Letters as manufactured by Gemini, or approved equal.
  - 2. ASI Sign Systems, Inc.: [www.asisignage.com](http://www.asisignage.com).
  - 3. Cosco Industries; Cast Aluminum: [www.coscoarchitecturalsigns.com](http://www.coscoarchitecturalsigns.com).
  - 4. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 5. Gemini, Inc.: [geminimade.com](http://geminimade.com).
  - 6. Inpro Corporation: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 7. Metallic Arts: [www.metallicarts.com](http://www.metallicarts.com)
  - 8. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and CBC Chapter 11B, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

### **2.03 DIMENSIONAL LETTERS**

- A. Applications: Building identification.
  - 1. Use individual metal letters.
  - 2. Mounting Location: Exterior as indicated on drawings.
- B. Metal Letters:
  - 1. Material: Aluminum casting.
  - 2. Thickness: 1/8 inch minimum.
  - 3. Letter Height: As indicated on drawings.
  - 4. Text and Typeface:
    - a. Character Font: Gurindam.
  - 5. Finish: As selected by Architect from manufacturer's full range.
  - 6. Color: As selected.
  - 7. Mounting: Concealed screws.

### **2.04 ACCESSORIES**

- A. Concealed Screws: Noncorroding metal; stainless steel or galvanized steel.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards, CBC Chapter 11B, and applicable building codes.
- D. Protect from damage until final inspection; repair or replace damaged items.

**END OF SECTION**

## **SECTION 10 14 23 PANEL SIGNAGE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Panel signage.
- B. Traffic and parking control, and site informational signage

#### **1.02 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- D. CBC - California Building Code.
- E. CBC Ch. 11B - California Building Code-Chapter 11B.
- F. CBC Chapter 11B - California Building Code-Chapter 11B.
- G. FED-STD-595C - Colors Used in Government Procurement (Fan Deck)..
- H. SAE AMS-STD-595A - Colors Used in Government Procurement.

#### **1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
  - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    - b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    - c. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Verification Samples: Submit samples showing colors, materials, and finishes specified.

- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- G. Manufacturer's qualification statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements for additional provisions.

#### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store under cover and elevated above grade.
- D. Store tape adhesive at normal room temperature.

#### **1.06 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Panel Signage:
  - 1. ASI Sign Systems, Inc.: [www.asisignage.com](http://www.asisignage.com).
  - 2. Best Sign Systems, Inc: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 3. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 4. Inpro Corporation: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 5. Mohawk Sign Systems, Inc: [www.mohawksign.com/#sle](http://www.mohawksign.com/#sle).
  - 6. Seton Identification Products: [www.seton.com/aec/#sle](http://www.seton.com/aec/#sle).
  - 7. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards, CBC Chapter 11B, and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.
  - 1. Requirements for Persons with Disabilities: Provide identifying devices meeting the requirements for the physically disabled of the following codes:
    - a. California Building Code (CBC) Title 24, Part 2; Chapter 11B, Accessibility.

- b. Code of Federal Regulations 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.
- c. Accessible Means of Egress Signage: CBC 1009.
  - 1) Directional Signage: CBC 1009.10.
    - (a) Provide directional signage complying with CBC Ch. 11B-703.5 indicating the location of all other means of egress and which are accessible means of egress:
      - (1) At exits serving a required accessible space but not providing an approved accessible means of egress.
- 2. Raised characters: Comply with CBC Ch. 11B-703.2.
  - a. Depth: It shall be 1/32 inch minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
  - b. Height: It shall be 5/8 inch minimum and 2 inches maximum based on the height of the uppercase letter "I". CBC Ch. 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 Ch. 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 Ch. 11B-703.2.4 and 11B-703.2.6; If characters are both visual and raised, provide stroke width min. 10% and max. 15% of the character "I".
  - e. Character Spacing: Spacing between individual tactile characters shall comply with CBC Ch. 11B-703.2.7.
    - 1) 11B-703.2.8 Line spacing. Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
  - f. Format: Text shall be in a horizontal format. CBC Ch. 11B-703.2.9.
  - g. Braille: It shall be contracted (Grade 2) and shall comply with CBC Ch. 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. Duplicate all characters on sign.
  - h. Mounting height: Tactile sign on signs shall be located 48 inches minimum to the baseline of the lowest Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. CBC Ch. 11B and Figure 11B-703.4.1.
  - i. Mounting location: A tactile sign shall be located per CBC Ch. 11B and Figure 11B-703.4.2 as follows:
    - 1) alongside a single door on the latch side.
    - 2) on the inactive leaf of a double door with one active leaf.
    - 3) to the right of the right hand door at double doors with two active leaves.
    - 4) on the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leaves.



- 5) so that a clear floor space of 18 x 18 inch minimum, centered on the tactile characters, is beyond the arc of any door swing between the closed position and 45 degree open position.
3. Visual characters shall comply with CBC Ch. 11B -703.5 and shall be 40 inches minimum above finish floor or ground.
  - a. Visual character stroke thickness of the uppercase letter “I” shall be 10% minimum and 20% maximum of the height of the character. CBC Ch. 11B-703.5.7.
  - b. Line Spacing between the baselines of characters within a message shall be 135% minimum and 170% maximum of the character height per CBC Ch. 11B-703.5.9.
  - c. Character Spacing between individual adjacent characters shall be 10% minimum and 35% maximum of character height per CBC Ch. 11B-703.5.8.
4. Pictograms shall comply with CBC Ch. 11B-703.6.
5. Symbol of accessibility shall comply with CBC Ch. 11B-703.7.
6. Variable message signs shall comply with CBC Ch. 11B-703.8.

## **2.03 PANEL SIGNAGE**

- A. Panel Signage:
  1. Application: Room and door signs.
  2. Description: Flat signs with engraved panel media, tactile characters.
  3. Sign Size: As indicated on drawings.
  4. Total Thickness: 1/8 inch.
  5. Sign Edges: Squared.
  6. Letter Edges: Squared.
  7. Corners: Squared.
  8. Color and Font, unless otherwise indicated:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper and lower case (title case).
    - c. Background Color: As scheduled.
    - d. Character Color: Contrasting color.
  9. Material: Laminated colored plastic engraved through face to expose core as background color.
  10. Profile: Flat panel in aluminum frame.
    - a. Frame Finish: Black anodized.
  11. Tactile Letters: Raised 1/32 inch minimum.
  12. Braille: Grade II, ADA-compliant.
  13. One-Sided Wall Mounting: Concealed screws.

## **2.04 SIGNAGE APPLICATIONS**

- A. Room and Door Signs:

1. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
  - a. Identify all single user toilet facilities as gender neutral facilities by a door symbol that complies with CBC Ch. 11B-216.8 and 11B-703.7.2.6.3.
    - 1) No pictogram, text, or braille is required.
    - 2) Tactile jamb signage shall comply with appropriate technical requirements of CBC Ch. 11B-703.
      - (a) Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM", or "UNISEX RESTROOM". DSA BU-17.
      - (b) Provide "RESTROOM" as the signage text, unless indicated otherwise on Drawings.
    - 3) See Drawings for actual sign to be provided.
  - b. Geometric Symbols: The symbol color shall contrast with door or wall.
    - 1) Comply with CBC Ch. 11B-216.8.1 at the entrances to toilet and bathing rooms.
    - 2) Comply with CBC Ch. 11B-703.7.2.6.
      - (a) Men's: An equilateral triangle, ¼ inch thick edges with edges 12 inches long and a vertex pointing upward.
      - (b) Women's: A circle, ¼ inch thick and 12 inches in diameter.
      - (c) Unisex (All Gender): A circle, ¼ inch thick and 12 inches in diameter with a equilateral triangle, ¼ inch thick edges with edges 12 inches long and a vertex pointing upward, superimposed on and geometrically inscribed within the circle and within the 12 inch diameter. The vertex of the triangle shall be located ¼ inch from the edge of the circle. The triangle shall contrast with the circle symbol, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door.
        - (1) No pictogram is to be provided.
      - (d) Mount within 1 inch of the centerline of the door at minimum 58 inches and 60 inches maximum from the centerline of the symbol to the finished floor surface.
2. Exits: Provide raised character and Braille exit signs per CBC Section 1013.4 at the following locations:

<b><u>Text</u></b>	<b><u>Location</u></b>
EXIT	Grade level exit door.
EXIT STAIR DOWN, EXIT STAIR UP	Exit door to exit stair.
EXIT RAMP DOWN, EXIT RAMP UP	Exit door to exit ramp.
EXIT ROUTE	Exit door to exit enclosure, exit passageway, exit corridor, or exit hallway.
TO EXIT	Exit door to horizontal exit.
EXIT WITH ALARM	Exit doors with an alarm.
EXIT ONLY or EXIT STAIR ONLY	Exit doors and stair exit doors which lock from outside and does not allow a

return

B. Interior Directional and Informational Panel Signs:

1. Assistive Listening Devices, include International Symbol of Access for Hearing Loss complying with CBC Ch. 11B Figure 11B-703.7.2.4..
  - a. Include International Symbol of Access for Hearing Loss, CBC Ch. 11B Figure 11B-703.7.2.4, with text "Assistive-Listening System Available". Use upper and lower case characters.
2. Occupant Load Signs:
  - a. Provide maximum occupancy load signs. Post in a conspicuous place near the main exit or exit access doorway from the room or space of rooms and areas indicated in the drawings.
  - b. Minimum size: 4 inches high by 8 inches wide, 7/8 inch high letters, 1 inch high numerals.
  - c. Sign to read: "MAXIMUM OCCUPANCY LOAD XXX". Indicate occupant load shown on drawings.

C. Traffic Signs: To match campus standards; locate where indicated on drawings.

1. Manufacturers:
  - a. Hawkins Traffic Safety Supply, Inc.: [www.hawkinstraftic.com](http://www.hawkinstraftic.com).
  - b. Safeway Sign Company: [www.safewaysign.com](http://www.safewaysign.com).
  - c. Western Highway Products, Inc.: [www.westernhighway.com](http://www.westernhighway.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Plaque Signs: Provide manufacturer's standard silk-screened signs, baked-on enamel applied over Diamond Grade (DG), (10-year projected life) retro-reflectorized backing; on aluminum or 16 gage galvanized steel sheet. Provide with anti-graffiti protective overlay film. Produce smooth, even, level sign surfaces, constructed to remain flat under installed condition within a tolerance of plus or minus 1/16-inch measured diagonally. Provide two holes for post mounting.
  - a. Traffic Entry Warning Signs: Sign text, traffic and regular parking control shall comply with requirements of California Code of Regulations (CCR) Title 24, Part 2, Section 11B-502.6 and regulations of local governing authorities.
    - 1) Single post mount, not less than 17 x 22 inches with white reflectorized copy on blue background conforming to No. 15090, SAE AMS-STD-595A (FED-STD-595C), 2 inch high letters (1 inch high when less than 70 inches above finish surface, CBC Ch. 11B Table 703.5.5) to read as indicated on Drawings.
    - 2) Position sign in a conspicuous location immediately adjacent to each entrance to off-street parking facility or immediately adjacent to and visible from each stall or space.
    - 3) Sign shall be mounted 60 inches from bottom of sign to the adjacent finish grade when mounted on walls or fence; or 80 inches to pedestrian way or sidewalk or as shown on the drawings.

- b. Parking Stall Signs: Sign text, accessible parking control shall comply with requirements of State of California Code of Regulations (CCR) - Title 24, Part 2, CBC Ch. 11B-502.6 in addition to requirements of State of California, Department of Transportation (CALTRANS) and regulations of local authorities having jurisdiction.
    - 1) Single post mount, not less than 70 square inches with white reflectorized copy on blue background conforming to No. 15090, SAE AMS-STD-595 (FED-STD-595C). Sign shall display a profile view of a wheelchair with occupant in white on blue background.
      - (a) Provide an additional sign below the accessible sign with the text "Minimum Fine \$250".
    - 2) Position one sign at the end of each parking space designated for disabled usage.
    - 3) One in every six spaces (CBC Ch. 11B-208.2.4), but not less than one, provide a 12 inch by 3-1/4 inch "Van Accessible" sign below the symbol of accessibility, wording per CBC Ch. 11B-502.6, 36 CFR 1191, and ADA Standards.
    - 4) Sign shall be mounted 80 inches from bottom of sign to finish grade of parking space or centered on wall at interior end of parking space at a minimum height of 60 inches above the parking space, finished grade, ground or sidewalk, to the bottom of the sign.
  - c. Fire Lane Signs:
    - 1) Single post mount, of size, color and sign text as shown on site plan or as required by local codes and fire department authority.
    - 2) Quantity, location and mounting heights to be determined by local fire department authority.
- 3. Support Posts:
  - a. Galvanized steel pipe, minimum 2-1/2 inch diameter or as indicated, with caps.
  - b. Concrete: Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 3,500 psi strength at 28 days, 3 inch slump; 3/4 inch nominal size aggregate.
- 4. Accessories: Provide welded galvanized steel fittings and galvanized or stainless steel bolts, nuts and washers.
- 5. Fasteners: Provide tamper-proof galvanized steel fasteners.
  - a. Tufnut System (714) 962-5838, Allegheny Bolt (Tampruf brand; (516) 568-1052 or equal.

## **2.05 FABRICATION**

- A. Provide signs and supports factory-prefabricated and pre-finished, ready for assembly and installation.

## **2.06 ACCESSORIES**

- A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.
- B. Exposed Screws: Stainless steel.

- C. Tape Adhesive: Double-sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

### **3.02 INSTALLATION AT BUILDING**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards, CBC Chapter 11B, and applicable building codes.
  - 1. Room and Door Signs: Locate on wall at latch side of door (per CBC Ch. 11B-703.4.2) a minimum of 48 inches to the baseline of the lowest braille cells; with baseline of highest line of raised character text at maximum 60 inches above finished floor.
    - a. Comply with CBC Ch. 11B-703.4.1 and CBC Ch. 11B -703.4.2
- D. Protect from damage until final inspection; repair or replace damaged items.

### **3.03 SITE AND TRAFFIC SIGN INSTALLATION**

- A. Locate informational signage as verified in field by Owner. Verify and coordinate sign locations to prevent conflict with underground utilities.
- B. Locate accessible car and van parking stall and drive approach signs where shown on Drawings and as required by applicable ordinances and regulations of authorities having jurisdiction. Verify and coordinate sign locations to prevent conflict with underground utilities.
- C. Excavate for sign support footings to depth as shown on Drawings or, if not shown, as recommended by manufacturer. Provide forms for concrete not supported by compacted soil.
- D. Set posts in concrete base, minimum 12 inch diameter and 18 inches deep; unless indicated otherwise on Drawings.
  - 1. Set sign support post plumb and so sign face will be perpendicular to stall or parallel to curb face, as applicable.
    - a. Set posts into pipe sleeve inserts set and anchored into concrete.
    - b. Fill annular space between posts and sleeves with grouting compound.
  - 2. Signs set in asphaltic paving surfaces or concrete sidewalks shall be mounted in core drilled holes minimum 8 inch diameter, 18 inches deep with top of base flush to finish.
  - 3. Firmly attach signs mounted to walls with appropriate expansion anchors or bolting, adhesive not permitted.
  - 4. Seal all holes water tight.
- E. Install plaque signage to posts, with panel facing traffic as necessary.

### **3.04 FIELD QUALITY CONTROL**

- A. Inspect signs for information content, appearance, location and Braille per as noted in Section 01 45 33 - Code-Required Special Inspections.

### **3.05 ADJUST AND CLEAN**

- A. Repair damage to signs incurred during installation. Replace signs which cannot be repaired to new condition. Clean glass, frames, and other sign surfaces, adjust hardware for proper operation.

**END OF SECTION**

**SECTION 10 14 63**  
**MARQUEE SIGN WITH ELECTRONIC MESSAGE DISPLAY**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Marquee sign with electronic message display.

**1.02 RELATED REQUIREMENTS:**

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Division 26 – Electrical.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- B. AISC (MAN) - Steel Construction Manual.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- D. NAAMM AMP 500-06 - Metal Finishes Manual.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the installation of sign with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

**1.05 DESIGN REQUIREMENTS**

- A. It is manufacturer's responsibility to design, engineer and provide required documentations to Owner for submittal to AHJ. Manufacturer is responsible for any corrections required by AHJ.
  - 1. Design, fabricate, and install steel members in accordance with AISC (MAN) and ASCE 7.
  - 2. Support structure and anchorage as required.
  - 3. Engineer sign to comply with wind load and seismic requirements of ASCE 7.
  - 4. Sign, support structure and associated foundations shall be designed by a registered structural engineer licensed in the state of California.

**1.06 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's product literature, component dimensions, describe components within assembly, anchorage and fasteners, and special installation requirements.

- C. Shop Drawings: Indicate plan views, elevations, sections, panel dimensions, details, and attachments to other work.
  - 1. Indicate sign style, lettering, and overall dimensions.
  - 2. Show typical details of assembly, erection and anchorage.
  - 3. Include wiring diagrams for power, control, and signal systems.
  - 4. Show complete layout and location of equipment, including required clearances and coordination with adjacent construction.
- D. Material Samples: Submit three samples each type, style and color of specified material.
- E. Manufacturer's Field Reports: Indicate procedures followed and supplementary instructions given.
- F. Maintenance Contracts.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Specimen Warranty.
- I. Project Record Documents: Record actual locations of electrical utilities and routing.
- J. Software: Copy of software provided under this section.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Provide three copies of programming and operating system manuals.
  - 3. Provide three copies of routine maintenance manuals.

#### **1.07 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide products by the same manufacturer.
- B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in California.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum five years of documented experience.
- E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

#### **1.08 DELIVERY, STORAGE AND HANDLING**

- A. Deliver products to site and protect from damage. Store until immediately prior to installation.

#### **1.09 WARRANTY**

- A. Product Support: Provide parts support for 10years.
- B. Provide a manufacturer's five year written warranty for:
  - 1. Material and installation of the identification display sign cabinet and faces.
  - 2. Material and installation of electric and electronic components.



3. Material and installation of electronic message display cabinet.
4. Material and installation of LED electrical message center.
5. Sign faces will not yellow or turn cloudy.

## **PART 2 – PRODUCTS**

### **2.01 MANUFACTURER**

- A. Basis of Design Product: Galaxy GS6 Series, GS6-15.85-RGB-SF. as manufactured by Daktronics, Inc., or approved equal.
- B. Manufacturers:
  1. Daktronics, Inc; Galaxy GS6 Series: [www.daktronics.com](http://www.daktronics.com).
  2. Fair-Play by Translux: [www.fair-play.com](http://www.fair-play.com).
  3. Nevco Scoreboard Company: [www.nevco.com](http://www.nevco.com).
  4. Quiel Signs: [www.quielsigns.com](http://www.quielsigns.com).
  5. Stewart Signs; TekStar LED: [www.stewartsigns.com](http://www.stewartsigns.com).
  6. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 GENERAL REQUIREMENTS**

- A. Monument, Single Sided
  1. Mounted to structural backing.
  2. LED message board.
  3. Dimension: 4' - 6" wide by 2' - 6" high, nominal.

### **2.03 IDENTIFICATION DISPLAY SIGN**

- A. Cabinet:
  1. Extruded aluminum.
  2. Heli-arc welded at reinforced mitered corners.
  3. Powder coated UV resistant paint finish.
  4. 24 inches high by width of electronic display cabinet.
- B. Lighting:
  1. Internal illumination: LED.
- C. Faces:
  1. Sign faces: 0.118 inch thick UV-resistant polycarbonate.
  2. Graphics: Pressure sensitive vinyl.
  3. Include the name of the school and school's mascot based on school colors. Graphics as provided by the school or as indicated on the drawings.
  4. Translucent colors: Pressure sensitive vinyl.
  5. Faces installation: Vandal resistant.

## 2.04 ELECTRONIC MESSAGE DISPLAY

### A. Cabinet:

1. Formed and welded weather proof aluminum cabinet.
2. Cabinet : NEMA 4X rating.
3. Thermostatically controlled fans shall automatically cool and warm the display.
4. Electrical components shall be labeled for easy service.

### B. Display:

1. Double sided and high definition
2. Graphics and Message Capability: Full color text, graphics, logos, basic animation, video clips, multiple font styles, and sizes
3. Line-and-Column Spacing: 15.85mm, 180 lines x 375 columns.
4. Character Height: 4.4 inches (7 pixel font).
5. Pixel Configuration: RGB, 1 red, 1 green, 1 blue.
6. Maximum Brightness: 12,000 nits.
7. Estimated LED Lifetime: 100,000+ hours (.5 brightness).
8. Optimal Horizontal Viewing Angle: 140 degrees.
9. Optimal Vertical Viewing Angle: 70 degrees.
10. Maximum Horizontal Readability Angle: 160 degrees.
11. Maximum Vertical Readability Angle: 90 degrees.
12. Minimum Viewing Distance: 37 feet.
13. Contrast Enhancement: Non-reflective black louvers and module face grooves disperse light.
14. Control Software: Venus Control Suite.
15. Power: 120/240 VAC single phase.
16. Display Dimming: 64 levels (automatic, scheduled or manual control).
17. Communication Options: Ethernet CAT6, Ethernet Fiber Optic, Ethernet Bridge Radio, and Remote Cellular,. Route as indicated on Electrical Drawings.
  - a. Outdoor Communication Hardware: Selected by Owner.
    - 1) 4G/5G Cellular Data Connection.
    - 2) Fiber or Wire Ethernet.
    - 3) RF Wireless communication system with a 4,000 feet line of sight with the signal to go through walls, trees and be completely WEP Encrypted to avoid hacking.
      - (a) Provide required components required to make the system operational.
18. Operating Temperature: -40°F to 120°F with 99% RH non-condensing.
19. Compliance Information: UL Listed, UL Energy Verified, FCC compliance.
20. Animated graphics either by themselves or in conjunction with text.
21. Display, various text sizes.

- a. 100 percent solid-state electronic operating circuitry.
  - b. Fast display speed to create smooth motion at 60 frames per second.
- 22. Front accessible for service.
- 23. The electronic message center shall be covered by a specially designed cover of UV-resistant polycarbonate.
- C. Control Equipment:
  - 1. Sign shall be equipped with the control software necessary to program messages.
  - 2. Load the software on a Owner supplied computer and provide an original hard copy of the control software as part of the close out package.
- D. Software requirements features:
  - 1. Automatic text formatting.
  - 2. Text and graphics to be added to the same frame.
  - 3. Animated graphic capability that runs AVI files video on full color models.
  - 4. Animated graphics as well as variety of font styles and sizes.
  - 5. Message compression for transmission to the sign. Accurate "what you see is what you get" display graphics to ensure what is seen on the computer screen is what you see on the sign.
  - 6. Scheduling in 12 or 24 hour format.
  - 7. Scheduling system to allow for scheduling over 12 months.
  - 8. Extensive help screens with excerpts from the operator's manual.
  - 9. Library functions for saving messages, animations and graphics to media.
  - 10. Twenty on and off modes for easy message creations. Five speed for each mode.
  - 11. Menu-guided control.
  - 12. Supports optional input devices such as a mouse.
  - 13. Simultaneous display and edit capability.
  - 14. Automatic rebooting of system disk is made after power outage.
  - 15. Password protection capability.
  - 16. The system software, program sequences and schedules can be stored on a disk.
  - 17. Uses graphics from Windows software.
  - 18. Menu guided control of software features.
  - 19. Interface with scanners, modems, etc.
  - 20. Message display to hold memory minimum up to 60 days without power.
- E. Electrical system requirements:
  - 1. 120 volts, single phase, 20 amp circuit.
  - 2. Equipped with internally mounted line voltage surge suppressor and disconnecting means.
  - 3. Sign shall be UL listed.
  - 4. Parts to be energized shall be grounded per CEC requirements.

## **2.05 MATERIALS**

- A. Support Angles: See Section 05 50 00 - Metal Fabrications.

## **2.06 METAL FINISHES**

- A. Comply with NAAMM AMP 500-06 for recommendations for applying and designating finishes.
- B. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **2.07 CONCRETE**

- A. 28 day compressive strength of 3,000 psi minimum.
- B. Refer to Section 32 13 13 - Site Concrete.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify the location of the sign and notify the owner of any conflict prior to start of work.
- B. Beginning of installation means installer accepts existing surfaces.
- C. Install in accordance with approved Shop Drawings and manufacturer's written recommendations.
- D. Coordinate the location of controller with Owner Representative or as indicated on the drawings.

### **3.02 INSTALLATION**

- A. Wall mounted Signs:
  - 1. Verify the structural integrity of the wall.
  - 2. Notify Owner Representative of any problems with support of the sign or means of attachment.
  - 3. Install per manufacturer's recommendations and shop drawings approved by AHJ.
  - 4. Fasteners shall be tamper proof.
- B. Install electrical conduit, pull box and wiring to power source.
  - 1. Conduit shall be concealed, run within tubular steel post or concealed by 12 gage steel channel cover, painted to match adjacent surface.

### **3.03 TOLERANCES**

- A. Signs shall be true and plumb after installation.

### **3.04 FIELD INSPECTIONS AND TESTS**

- A. Inspect equipment, signs, materials and installation for compliance with the applicable standards.

B. Field Testing:

1. Before Substantial Completion, perform operational tests to verify components including the actual sign, hardware and software.
2. Test electrical connections and low voltage connection.

**3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Vendor Demonstration: Demonstrate operation of system to Owner's personnel.
  1. Use operation and maintenance data as reference during demonstration.
  2. Conduct walking tour of project.
  3. Briefly describe function, operation, and maintenance of each component.
- D. Vendor Training: Train up to two Owner's personnel on operation and maintenance of system.
  1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  2. Provide minimum of one hour of training of staff.
  3. Provide minimum of one hour of training of maintenance and operations.
  4. Instructor: Manufacturer's training personnel.
    - a. The technician must be completely familiar with the system construction, assembly and testing of the equipment.
    - b. The technician will set up the operating system, test and make the control system operational as well as the display system while on site.
    - c. In addition, the technician shall go over maintenance requirements and replacement parts with a maintenance and operations representatives.
  5. Location: At project site.

**3.06 CLEANUP**

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

**3.07 PROTECTION**

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

**END OF SECTION**

**SECTION 10 21 13.17**  
**PHENOLIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic toilet compartments. TP-1

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Concealed steel support members.
- B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports, included in wall framing and plates and above ceiling framing.
- C. Section 10 28 00 - Toilet Accessories.
- D. California Building Code (CBC) chapter 11B, disabled accessibility regulations.

**1.03 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. CBC Ch. 11B - California Building Code-Chapter 11B.
- F. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
  - 1. Show plan and elevation views for each room. Indicate types and thicknesses of materials and assemblies.
  - 2. Attachment details.
- D. Samples: Submit two samples of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.

- E. Working Mock-up: Submit the following.
  - 1. Submit mock-ups of showing specified hardware types.
  - 2. Submit mock-ups of specified and proposed substitute manufacturers.
- F. Manufacturer's Installation Instructions: Indicate special procedures.

#### **1.06 SEQUENCING AND SCHEDULING**

- A. Complete tile and painting Work before toilet partition installations.
- B. Coordinate dimensions and locations of cut-outs and panel reinforcement with approved toilet accessories.
- C. Coordinate backing and blocking provisions in walls.

#### **1.07 PROJECT CONDITIONS**

- A. Field Measurements: Verify field design and field dimensions before submitting shop drawings and before fabrication.
- B. Environmental Conditions: Maintain humidity and temperature in ranges required by manufacturer.

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide ten year manufacturer limited warranty for panels, doors and stiles against breakage, corrosion and delamination.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with NFPA 286; Flame Spread Class A per ASTM E84, UL 723, and CBC Sections 803.1.2, 803.11, 2604.2.4.
  - 1. Flame Spread Rating ASTM E84: Provide units bearing the label of Underwriters' Laboratories, or other testing agency acceptable to the State Fire Marshal, indicating that the units provide the specified flame spread rating. CBC Table 803.13.
    - a. Class A Flame spread rating 26-75, smoke developed 0-450 per ASTM E84.
- B. Installation shall meet requirements for the physically disabled of the California Code of Regulations (CCR) Title 24 Part 2 and latest amendments to the ADA Standards and 36 CFR 1191.
- C. California Building Code (CBC) disabled accessibility regulations.
  - 1. Wheelchair accessible compartment shall comply with CBC CBC Ch. 11B-604.8.1.
  - 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Ch. 11B Figure 604.8.1.4.
    - a. It shall be 9 inches high minimum above the finish floor and 6 inches deep minimum beyond the compartment side face of the partition, exclusive of partition support members.

- b. It shall be 12 inches high minimum above the finish floor for children's use.
  - c. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces.
  - d. Toe clearance is not required in a compartment greater than 66 inches wide.
- 3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of of urinals and water closets totals six or more fixtures.
  - a. Such compartment shall be provided in the same quantity as wheelchair accessible compartments per CBC Ch. 11B-213.3.1 and shall comply with CBC Ch. 11B-604.8.2.
- 4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Ch. 11B-404 except that if the approach is on the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches minimum. CBC Ch. 11B Figure 604.8.2.
- 5. A door pull complying with CBC Ch. 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
- 6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. CBC Ch. 11B-604.8.2.2.

## **2.02 PHENOLIC TOILET COMPARTMENTS**

- A. Basis of Design Product: Phenolic Privacy Partitions as manufactured by Bradley Corporation, or approved equal.
- B. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
  - 1. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.3 inch nominal from the edge to allow for 0.175 inch nominal overlap to prevent line-of-sight into the toilet compartment.
    - a. Privacy strips fastened or adhered onto the partition material are not acceptable.
  - 2. Floor Clearance: 4 inches, nominal.
  - 3. Color: Single color as selected.
- C. Doors:
  - 1. Thickness: 3/4 inch.
  - 2. Width: 24 inch.
  - 3. Width for Handicapped Use: 36 inch.
  - 4. Height: 72 inches.
- D. Panels:
  - 1. Thickness: 1/2 inch.
  - 2. Height: 72 inches.
  - 3. Depth: As indicated on drawings.
- E. Pilasters:



1. Thickness: 3/4 inch.
2. Width: As required to fit space; minimum 3 inch.

### **2.03 FABRICATION**

- A. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required.

### **2.04 ACCESSORIES**

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 4 inch high, concealing floor fastenings.
  1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
  2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Wall and Pilaster Brackets: Polished stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
  1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- E. Hardware: Satin stainless steel:
  1. Continuous-type hinge, self closing.
  2. Door Latch: Slide type with exterior emergency access feature.
    - a. Configuration: Surface mounted and through bolted to door with one way sex bolts
    - b. Slide bolt designed to prevent wrong direction breakthrough of door and to have no exposed parts on door exterior.
    - c. Material: Cast stainless steel.
  3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
    - a. Configuration: Wrap around flange surface mounted and through bolted to pilaster with one way sex bolts
    - b. Material: Cast stainless steel.
    - c. Strikes: 6 inches long.
    - d. Door bumper to accommodate projection of all door hardware and toilet accessories.
  4. Coat hook with rubber bumper; one per compartment, mounted on door.
    - a. Mount such that no portion is over 40 inches above finish floor , at accessible stall, and 48 inches above finish floor at non-accessible stall.
    - b. Provide only if not provided under Section 10 28 00 - Toilet Accessories. If not otherwise provided or shown on Drawings, provide one at each toilet stall door.

5. Provide door pull for outswinging doors.
  - a. Surface mounted U-shaped or wire pulls on both sides of accessible compartment doors.
  - b. Material: Cast stainless steel.
  - c. Basis of Design Product: Guardian #5403 with 3-1/2 inch centers as manufactured by Alan Lewis Inc., or approved equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to application of gypsum board tile backing or other wall finishes, inspect framing at toilet compartments and urinal screens and ensure that necessary and proper backing is provided in wall for anchoring of panels.
- B. Verify that field measurements are as indicated on shop drawings.
- C. Verify correct spacing of and between plumbing fixtures.
- D. Verify correct location of built-in framing, anchorage, and bracing.

### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
  1. Use fasteners as shown on reviewed shop drawings.
    - a. Where fasteners to substrate are not indicated, provide fasteners as specified in Section 057513 - Decorative Perforated Panels.
  2. Secure divider panels to built-in anchorage devices using concealed fasteners. Level, plumb and tighten installation with devices provided.
  3. Anchors to Concrete:
    - a. Use stainless steel expansion anchors, or self-threading concrete anchors.
    - b. Power-driven fasteners or lead expansion shields are not acceptable.
  4. Anchors to Plaster or Gypsum Wallboard (with and without tile finish):
    - a. Use sheet metal screws to metal framing or backing, wood screws to wood framing or backing.
    - b. Molly-type fasteners are not acceptable.
  5. Panel-to-Wall Installation:
    - a. Provide clearances of not more than 1 inch between panels and walls.
    - b. Secure panels to walls with continuous brackets so that holes for wall anchorage occur in masonry or tile joints.
    - c. Secure panels in position with manufacturer's recommended anchoring devices.

- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

### **3.03 TOLERANCES**

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

### **3.04 ADJUSTING**

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

### **3.05 CLEANING**

- A. Cleaning After Installation: Clean exposed surfaces of panel systems using materials and methods recommended by manufacturer.
- B. Protection: Provide protection as necessary to prevent damage during remainder of construction period.
- C. Final Cleaning: Clean partitions to dust-free condition prior to Final Acceptance.

## **END OF SECTION**

**SECTION 10 26 00**  
**WALL AND DOOR PROTECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Corner guards.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

**1.03 REFERENCE STANDARDS**

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.

- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

#### **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide five year manufacturer and installer warranty for metal crash rails.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Corner Guards:
  - 1. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 2. Construction Specialties, Inc: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - 3. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 4. Koroseal Interior Products: [www.koroseal.com/#sle](http://www.koroseal.com/#sle).
  - 5. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 6. Trim-Tex, Inc: [www.trim-tex.com/#sle](http://www.trim-tex.com/#sle).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 PERFORMANCE CRITERIA**

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

#### **2.03 PRODUCT TYPES**

- A. Corner Guards - Surface Mounted:
  - 1. Material: Type 304 stainless steel, No. 4 finish, 16 gauge, 0.054 inch thick.
  - 2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
  - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

4. Width of Wings: 1 inches.
  5. Corner: Radiused.
  6. Color: #4 Satin finish.
  7. Length: One piece.
  8. Preformed end caps.
- B. Adhesives and Primers: As recommended by manufacturer.
  - C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
  - D. See Section 09 21 16 for supports in stud wall construction.

#### **2.04 FABRICATION**

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

#### **2.05 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
  1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

#### **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to ceiling.

#### **3.03 TOLERANCES**

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

### **3.04 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

**END OF SECTION**

## **SECTION 10 28 00 TOILET ACCESSORIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Utility room accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 40 00 - Cold-Formed Metal Framing and 09 21 16 - Gypsum Board Assemblies: Concealed supports for accessories, including in wall framing and plates.
- B. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- E. ASTM C1036 - Standard Specification for Flat Glass.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.
- H. CBC Ch. 11B - California Building Code-Chapter 11B.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

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

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.



2. Tools: One each of every special tool required for maintenance of fasteners and operable parts.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Provide toilet accessories meeting the requirements for the physically disabled of the California Building Code (CBC), Title 24 Part 2, CBC Section 11B, and 2010 ADA Standards, as amended.
- B. Accessible requirements:
  1. Elements of sanitary facilities shall be mounted at locations in compliance with CBC Section 11B-602 through 11B-612.
  2. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609.
    - a. 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.
    - b. The space around the grab bars shall be as follows:
      - 1) 1-1/2 inches between the grab bar and the wall. CBC Section 11B-609.3.
      - 2) 1-1/2 inches minimum between the grab bar and projecting objects below and at the ends.
      - 3) 12 inches minimum between the grab bar and projecting objects above.
  3. Toilet accessories required to be accessible shall be mounted with any operable part at maximum 40 inches above the finish floor. CBC Section 11B-603.5.
  4. The grab bar shall not project more than 3 inches into the 48 inches minimum clear space required required in front of the water closet. CBC Section 11B-609.3.
  5. Toilet tissue dispensers are to be continuous flow type. CBC Section 11B-604.7.
  6. Toilet paper and feminine napkin disposals located on the grab bar side of the accessible toilet room or stall shall not project more than the grab bar or 3 inches from the finished wall surface nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar. (Legacy DSA Interpretation.)
    - a. Accessories surface mounted above grab bar will restrict usability.
  7. All other accessories shall not project more than 4 inches from wall surface, but cannot encroach into any required clear space.
  8. Shower controls shall comply with CBC Section 11B-608.5.
  9. Shower seats shall comply with CBC Section 11B-610.3 Shower compartment seats.

### **2.02 MANUFACTURERS**

- A. Commercial Toilet, Shower, and Bath Accessories:
  1. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  2. Bobrick Washroom Equipment, Inc.: [www.bobrick.com](http://www.bobrick.com).
  3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  4. Gamco: [www.gamcousa.com](http://www.gamcousa.com).

5. Georgia-Pacific Professional: [www.blue-connect.com/#sle](http://www.blue-connect.com/#sle).
  6. Kimberly-Clark: [www.KCprofessional.com](http://www.KCprofessional.com).
  7. Or Equal Substitutions: Section 01 60 00 - Product Requirements.
- B. Provide products of each category type by single manufacturer.

### **2.03 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  1. Grind welded joints smooth.
  2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Stainless steel except where fully concealed may be hot dip galvanized; tamper-proof; security type.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

### **2.04 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

### **2.05 COMMERCIAL TOILET ACCESSORIES**

- A. Toilet Paper Dispenser: Double roll, recessed, stainless steel unit with pivot hinge, tumbler lock.
  1. Basis of Design Product: Recessed Multi-Roll Toilet Tissue Dispenser B-3888 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- B. Combination Towel Dispenser/Waste Receptacle: Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges.
  1. Waste receptacle liner: Reusable, heavy-duty vinyl.
  2. Towel dispenser capacity: 600 C-fold.
  3. Waste receptacle capacity: 12 gallons.
  4. Basis of Design Product: Classic Series Recessed Convertible Paper Towel Dispenser and Waste Receptacle B-3944 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.

- C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
  - 1. Minimum Capacity: 40 ounces.
  - 2. Basis of Design Product: Classic Series Surface Mounted Soap Dispenser B-2111 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- D. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
  - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
  - 2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
  - 3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
  - 4. Basis of Design Product: Mirror with Stainless Steel Channel Frame B-165.2430 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- E. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
  - 1. Minimum capacity: 250 seat covers.
  - 2. Basis of Design Product: Classic Series Surface Mounted Seat Cover Dispenser B-221 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- F. Grab Bars: Stainless steel, peened surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Finish: Satin, with peened gripping surface (suffix.99).
    - d. Length and Configuration: As indicated on drawings.
    - e. Basis of Design Product: Snap Flange B-5806 Series as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
  - 1. Basis of Design Product: Recessed Sanitary Napkin Disposal B-353 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.

## **2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS**

- A. Specified in 22 40 00 - Plumbing Fixtures.

## **2.07 UTILITY ROOM ACCESSORIES**

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Drying rod: Stainless steel, 1/4 inch diameter.

2. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
3. Length: 36 inches.
4. Product: See schedule on Drawings.
5. Basis of Design Product: Utility Shelf with Mop/Broom Holders and Rag Hooks B-224 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Before covering wall framing with gypsum board, examine framing to ensure that backing plates and grab bar mounting kits have been installed behind surface mounted accessories in such positions as to receive all attachment screws.
- D. Verify that pipes, vents, conduits and other construction features do not protrude into rough wall opening space required for recessed accessories.
- E. Verify that field measurements are as indicated on drawings.
- F. Verify installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

### **3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
  1. Exception: Install surface mounted accessories other than grab bars with screws, molly or toggle bolts only to studs or through backing plates attached directly to studs.
  2. At combination units placed behind a grab bar set the perimeter trim tight against the backing board.
    - a. Face of this unit shall not project beyond the tile or applied finish face. Maintain the required 1-1/2 inch clearance.
    - b. Coordinate surrounding finish trim with bullnose tile, radius, or sloped profile trim.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  1. Grab Bars: As indicated on drawings.
    - a. Adult mounting height to be between minimum 33 inches to maximum 36 inches to top tangent point. CBC 11B-609.4 Position of Grab Bars.
  2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
  3. Seat Cover Dispenser:

- a. Shall not be located closer than 1-1/2 inches clear of the tangent point of the grab bar.
  - b. If surface mounted and located under the grab bar provide a minimum 5 inches clear under unit for refilling.
4. Shelf with Mop and Broom Holders: 40 to 48 inches. CBC 11B-603.4 Coat hooks, shelves and medicine cabinets
5. Other Accessories: As indicated on drawings.

#### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 10 44 00**  
**FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 21 16 - Gypsum Board Assemblies: Finishing at recessed fire extinguisher cabinets.

**1.03 REFERENCE STANDARDS**

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- B. FM (AG) - FM Approval Guide.
- C. Fire Extinguishers Standard: California Fire Code (CFC) section 906.
- D. Title 19 California Code of Regulations.
- E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 1. Use 2016 as indicated in 2019 CBC Referenced Standards.
- F. NFPA 10 - Standard for Portable Fire Extinguishers.
- G. UL (DIR) - Online Certifications Directory.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
  - 1. Submit for fire extinguishers and cabinets, and indicate compliance with local and State fire regulations for extinguisher mounting heights and locations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.05 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Conform to all requirements of the local and State Fire Marshal. Conform to all applicable requirements of the California Building Code (CBC), CFC, ADA and Title 19 CCR.
  - 1. Fire Extinguisher cabinets must comply with CBC sections 11B-305 Clear floor or ground space, 11B-307 Protruding Objects, 11B-308 Reach Ranges, 11B-309/811.4 Operable Parts, 11B-403 Walking Surfaces, 11B-811.3 Height.
  - 2. Comply with Section 11B-205 Operable Parts and 309 Operable Parts; Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf (22.2 N) of force. CBC Section 11B-309.4 Operation.
- B. Fire Extinguisher Requirements: Conform to NFPA 10, California Fire Code and Title 19 requirements for portable fire extinguishers.
- C. Current listing by California State Fire Marshal.

### **2.02 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Activar Construction Products Group; JL Model Cosmic Series: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Amerex; [www.amerex-fire.com](http://www.amerex-fire.com).
  - 3. Ansul, Inc. : [www.ansul.com](http://www.ansul.com).
  - 4. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
  - 5. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 6. Nystrom, Inc: [www.nystrom.com/sle](http://www.nystrom.com/sle).
  - 7. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 8. Pyro-Chem, a Tyco Business: [www.pyrochem.com/#sle](http://www.pyrochem.com/#sle).
  - 9. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmopolitan Series: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
  - 3. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 4. Nystrom, Inc: [www.nystrom.com](http://www.nystrom.com).
  - 5. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 6. Strike First Corporation of America: [www.strikefirstusa.com](http://www.strikefirstusa.com).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage. Fully serviced and tagged.
  - 1. Stored Pressure Operated: Deep Drawn.
  - 2. Class: 2-A: 10B:C.
  - 3. Size: 10 pound.
  - 4. Size and classification as scheduled.
  - 5. Finish: Baked polyester powder coat color as selected.

## **2.04 FIRE EXTINGUISHER CABINETS**

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 and ASTM E119 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
  - 1. Formed stainless steel sheet; 0.036 inch thick base metal.
  - 2. Basis of Design Product; 6 inch stud: Cosmopolitan Stainless Steel FE Cabinet Trimless 1034PW-W-17-PUCH as manufactured by Activar, or approved equal.
  - 3. Basis of Design Product; 4 inch stud: Cosmopolitan Stainless Steel FE Cabinet Semi-Recessed 1036V17LDVRF 1-1/2" Square Trim as manufactured by Activar, or approved equal.
  - 4. Basis of Design Product; 3-1/2 inch stud: Cosmopolitan Stainless Steel FE Cabinet Semi-Recessed 1037V17LDVRF 3" Rolled Trim as manufactured by Activar, or approved equal.
- C. Fire Rated Cabinet Construction: One-hour fire rated, or as required by wall assembly.
  - 1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.
  - 2. Basis of Design Product; 8 inch stud: Cosmopolitan Stainless Steel FX Cabinet Trimless 1034D17FX2-W-PUCH as manufactured by Activar, or approved equal.
    - a. Requires minimum 7-1/4 inch from finish face of gypsum board. Can be used with 2 layers of gypsum board and 6 inch metal stud.
  - 3. Basis of Design Product; 6 inch stud: Cosmopolitan Stainless Steel FX2 Fire Rated FE Cabinet Semi-Recessed 1036V17FX2-LDVRF 1-1/2" Square Trim as manufactured by Activar, or approved equal.
  - 4. Basis of Design Product; 4 inch stud: Cosmopolitan Stainless Steel FX2 Fire Rated FE Cabinet Semi-Recessed 1037V17FX2-LDVRF 3" Rolled Trim as manufactured by Activar, or approved equal.
- D. Cabinet Configuration: Trimless Recessed type.
  - 1. Size to accommodate accessories.



2. Exterior nominal dimensions of 10-5/8 inch wide by 24 inch high by 6 inch deep. Add 1 inch for fire rated.
  3. Trimless type.
  4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- E. Cabinet Configuration: Recessed type.
1. Size to accommodate accessories.
  2. Exterior nominal dimensions of 13-7/8 inch wide by 27-3/8 inch high by 6 inch deep.
  3. Trim: Flat square edge, with 13-7/8 inch wide face.
  4. Projected Trim: Returned to wall surface, with 3/8 inch projection, and 1.69 inch wide face.
  5. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- F. Cabinet Configuration: Semi-recessed type.
1. Size to accommodate accessories.
  2. Exterior nominal dimensions of 13-7/8 inch wide by 27-3/8 inch high by 6 inch deep.
  3. Trim: Flat rolled edge, with 13-7/8 inch wide face.
  4. Projected Trim: Returned to wall surface, with 3 inch projection, and 1.69 inch wide face.
  5. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- G. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with roller type catch. Hinge doors for 180 degree opening with continuous piano hinge.
1. Provide manufacturer's option for compliance with Americans with Disabilities Act (ADA) projection criteria and accessible handle.
  2. Latching and locking hardware operable with a single effort by lever-type hardware or other type hardware not requiring ability to grasp opening hardware and not requiring an opening force greater than 5 pounds.
- H. Door Style: Slot glazed style vertical duo-panel with glazing, continuous hinge, roller catch, zinc plated pull handle and cylinder lock.
1. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- I. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- J. Weld, fill, and grind components smooth.
- K. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.
- L. Finish of Cabinet Interior: White colored enamel.

## **2.05 ACCESSORIES**

- A. Extinguisher Brackets: Formed steel, chrome-plated.

1. Where indicated, at Custodial, Mechanical and Electric Rooms, provide surface mounted bracket with retainer straps.
  2. Basis of Design Product: Model 846 as manufactured by Larsen's Manufacturing Company, or approved equal.
  3. Provide brackets with 3-point connection within cabinets and for locations where fire extinguisher is wall-mounted without cabinet.
    - a. Bracket design shall prevent accidental dislodgement of extinguisher.
    - b. Provide size required for type and capacity of specified extinguisher.
- B. Cabinet Signage: ...
1. Identify extinguisher locations with red lettered white decals spelling "FIRE EXTINGUISHER INSIDE" applied to wall or exterior door surface outside each room housing a fire extinguisher. Letter size, style and location as selected by Architect, to comply with local fire authority requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### **3.02 INSTALLATION**










- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets in prepared recesses in walls. Verify recess dimensions for standard non-rated and fire rated where required.
- C. Install cabinets plumb and level in wall openings, 24 inches from finished floor to inside bottom of cabinet.
  1. Cabinet installation shall conform to requirements of the Fire Marshal, CBC, and ADA for location and height of extinguisher.
  2. Place cabinet to position the extinguisher handle at maximum 48 inches AFF.
  3. Place Cabinet 40 inches (1,016 mm) AFF to centerline of cabinet handle.
- D. Secure rigidly in place.
  1. Use oval head fasteners with exposed surfaces of same finish as cabinet.
  2. Fasten cabinets to wood studs with full threaded wood screws or with sheet metal screws.
- E. Maintain acoustical integrity of walls by filling cavity around box with unfaced fiberglass insulation or by applying electrical outlet box acoustical sheeting to the back, top, bottom and sides.
- F. Place extinguishers in cabinets and on wall brackets.
  1. Mount freestanding fire extinguishers on steel brackets on walls at locations indicated on drawings, with fire extinguisher handle located maximum 48-inches above finish floor. Mount steel brackets to solid backing.

2. Mount fire extinguishers to brackets in all cabinets.
3. Place fire extinguishers immediately prior to issuance of "Notice of Completion" or sooner if directed by Fire Marshal or Owner.

### 3.03 SCHEDULES

- A. All extinguishers and cabinets shall be quantities and locations as indicated per Drawings or as indicated by field inspection by Fire Marshall.
- B. Place the fire extinguishers based on the allowable maximum travel distance to extinguisher as indicated on Drawing and as follows:
  1. Class A = 75 feet
  2. Class B = 50 Feet
  3. Class C = 50 Feet
  4. Class K = 30 Feet
- C. Multi-Purpose Room: 1 Dry Chemical Type 4A-80BC, 10 lb. capacity, baked enamel finish extinguisher placed in specified cabinet. Ansul Sentry 10 Model No. AA10S.
- D. General Use: 1 Dry Chemical Type 2A-10BC, 10 lb. capacity, baked enamel finish extinguisher placed in specified cabinet. Ansul Sentry 10 Model No. AA10S.
- E. Classroom Use: 1 Dry Chemical Type 2A-10BC, 2.5 lb. capacity, baked enamel finish extinguisher placed in specified cabinet. Ansul Sentry 10 Model No. AA10S.
- F. Vocational Areas: 1 fire blanket, 1 Dry Chemical Type 4A:40B:C JL Industries Galaxy 6, 6 lb. capacity extinguisher, placed in JL Industries Ambassador 1013-G-10 cabinet surface mounted to CMU, 13-11/16 W by 27-3/16 H by 6-1/2 D inches, with vertical lettering.

### 3.04 TYPES

Fire Class	Geometric Symbol	Pictogram	Intended Use	Mnemonic
A			Ordinary solid combustibles	A for "Ash"
B			Flammable liquids and gases	B for "Barrel"
C			Energized electrical equipment	C for "Current"
D		(none)	Combustible metals	D for "Dynamite"
K			Oils and fats	K for "Kitchen"

Fire extinguishing capacity is rated in accordance with ANSI/UL 711: Rating and Fire Testing of Fire Extinguishers.

The ratings are described using numbers preceding the class letter, such as 1-A:10-B:C.

The number preceding the A multiplied by 1.25 gives the equivalent extinguishing capability in gallons of water.

The number preceding the B indicates the size of fire in square feet that an ordinary user should be able to extinguish.

There is no additional rating for class C, as it only indicates that the extinguishing agent will not conduct electricity, and an extinguisher will never have a rating of just C.

## **END OF SECTION**

## **SECTION 10 51 13 METAL LOCKERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Metal lockers.
- B. Locker benches.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications.
- B. Section 09 22 16 - Non-Structural Metal Framing: Backing requirements.
- C. Section 09 21 16 - Gypsum Board Assemblies: Backing requirements.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
  - 1. Submit with reference to Architect's detail numbers.
  - 2. Indicate lockers in detail, method of installation, fillers, trim, base and accessories, with actual dimensions of lockers for proper layout.
  - 3. Coordinate with available space to install lockers, as per field measurements.
- D. Color Selection samples: Provide three copies of manufacturer's standard color range (8 colors minimum).
  - 1. Provide one of the three copies on metal samples.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect locker finish and adjacent surfaces from damage.

#### **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide a lifetime warranty for materials and workmanship. Complete forms in Owner's name and register with manufacturer.

- C. Installer Warranty: Provide 2-year warranty for workmanship, excluding the finish and vandalism commencing on the Date of Final Inspection. Complete forms in Owner's name and register with installer.
- D. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
  - 1. Excluding finish, vandalism and improper installation.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Provide lockers meeting the requirements for the physically disabled of the California Code of Regulations (CCR), Title 24, Part 2, and ADA Standards, as amended. CBC Chapter 11B-225.2.1 and 811.
  - 1. Where lockers are provided, at least 5%, but no fewer than one of each type must comply with CBC Chapter 11B-811.
  - 2. Provide latch and locking hardware that does not require twisting, pinching, or grasping to operate. CBC Chapter 11B-309.4.
  - 3. Provide shelf and pole at 48 inches maximum AFF and lower shelf at 15 inches minimum AFF. CBC Chapter 11B-308 and 811.3

### **2.02 MANUFACTURERS**

- A. Metal Lockers:
  - 1. DeBourgh Manufacturing Co; Core Series Lockers: [www.debourgh.com/#sle](http://www.debourgh.com/#sle).
  - 2. List Industries, Inc: [www.listindustries.com/#sle](http://www.listindustries.com/#sle).
  - 3. Lyon Workspace Products: [www.lyonworkspace.com/#sle](http://www.lyonworkspace.com/#sle).
  - 4. Penco Products, Inc: [www.pencoproducts.com/#sle](http://www.pencoproducts.com/#sle).
  - 5. Republic Storage Systems Co: [www.republicstorage.com/#sle](http://www.republicstorage.com/#sle).
  - 6. Salisbury Industries: [www.lockers.com](http://www.lockers.com).
  - 7. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### **2.03 LOCKER APPLICATIONS**

- A. Wardrobe Lockers: Metal lockers, wall mounted with matching closed base.
  - 1. Basis of Design Product: 2-Tier as manufactured by Penco Products, Inc, or approved equal.
  - 2. Width: 12 inches.
  - 3. Depth: 15 inches.
  - 4. Height: 72 inches.
  - 5. Configuration: Two tier.
  - 6. Fittings: Size and configuration as indicated on drawings.
    - a. Hat shelf.

- b. Single shoe shelf.
  - c. Coat rod.
  - d. Hooks: One single prong.
- 7. Ventilation: Louvers at top and bottom of door panel.
- 8. Locking: Padlock hasps, for padlocks provided by Owner.
  - a. Locking Action: Positive, automatic type, whereby locker may be locked when open, then closed without unlocking.
- 9. Provide sloped top.
- 10. Color: To be selected from manufacturer's full range by Architect.

## **2.04 METAL LOCKERS**

- A. Accessibility: Design units indicated on drawings as 'accessible' to comply with CBC Ch. 11B and ADA Standards.
- B. Locker Case Construction:
  - 1. Heavy-Duty, Welded Construction: Made of formed and welded together sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
    - a. Assembly: Do not use bolts, screws, or rivets to assemble locker bodies.
    - b. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
      - 1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
        - (a) Uncoated.
      - 2) Body and Shelves: 16 gauge, 0.0598 inch.
      - 3) Backs: 18 gauge, 0.0478 inch.
      - 4) Reinforced Bottom:
        - (a) Provide 16 gauge spacer channel welded to locker bottom from front to back for a more secure installation. Spacer channel to have full height 1/2-inch ID tube welded over anchor holes to eliminate deflection upon locker installation.
      - 5) Base: As indicated on Drawings.
        - (a) Height: 4 inches.
    - c. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
    - d. Where ends or sides are exposed, provide flush panel closures.
    - e. Provide filler strips where indicated or required, securely attached to lockers.
- C. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
  - 1. Door Thickness: 16 gauge, 0.0598 inch, minimum.
  - 2. Form recess for operating handle and locking device.

- D. Latches and Door Handles: Manufacturer's standard.
  - 1. Latching: Manufacturer's standard for locking arrangement selected.
    - a. Accessible Lockers: Three-point projecting turn handle.
      - 1) Provide CBC Chapter 11B and ADA Standards compliant lock/latch.
      - 2) Basis of Design Product: 163MKA Built-in Combination Lock for Lift Handle ADA lockers as manufactured by Master Lock, or approved equal.
    - b. Three-Point Lift Handle Gravity Latch: Pocket-mounted, provide for doors 18 inches or taller.
      - 1) Handle Pocket, Recess: Stainless steel flush-mounted cup recessed into face of door.
      - 2) Handle: Steel finger lift mechanism with exposed portion encased in molded plastic trigger.
        - (a) Padlock Eye: Integral with lift trigger, sized for use with 9/32 inch diameter padlock shackles.
      - 3) Latching Mechanism: Spring activated nylon slide latch enclosed in steel latch channel allows closing of door while padlock or built-in lock is in position.
      - 4) Rubber bumpers riveted to door stops for silent operation.
- E. Cup, Pocket: Manufacturer's standard, with integral pull, and recessed surface punched for installation of lock, latch lift mechanism, and number plate.
- F. Hinges: Continuous piano hinge with powder coat finish to match locker color.
- G. Sloped Top: 20 gauge, 0.0359 inch, with closed ends.
- H. Trim: 20 gauge, 0.0359 inch.
- I. Coat Hooks: Stainless steel or zinc-plated steel.
- J. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1 inch high of block font style with ADA designation, in contrasting color.
- K. Locks: Locker manufacturer's standard type indicated in Applications article above.
- L. Locker Groups: Gang lockers in groups of two and assemble in factory for shipment as a single unit.

## **2.05 LOCKER BENCHES**

- A. Locker Benches: Stationary type; bench top of laminated maple; painted steel pedestals.
  - 1. Accessibility: Comply with CBC Ch. 11B and ADA Standards.
- B. Standard Size: Manufacturer's standard, nominal 9.5 inches wide by 1-1/4 inch thick.
- C. ADA Accessible Seat: 20-24 inches wide x 48 inches long.
  - 1. Provide back support, where required by CBC Chapter 11B 11B-903.4.
  - 2. Basis of Design Product: ADA Bench with backrest as manufactured by Lyon Workspace, or approved equal.
- D. Pedestal supports.
  - 1. Manufacturer's standard, nominal 2 inch diameter, heavy-duty powder coated steel pipe with cast top mounting bracket.



- a. Spaced maximum 72 inches o.c. and within 12 inches of bench ends.
2. At ADA benches, provide four point pedestal supports and additional frame as required to support wider bench.
3. Color: To be selected by Architect.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Bolt adjoining locker units together to provide rigid installation.
  1. Connect at four points, two at top and two at bottom, using 1/4 inch bolts.
- F. Install end panels, filler panels, and sloped tops.
- G. Install fittings if not factory installed.
- H. Replace components that do not operate smoothly.

#### **3.03 CLEANING**

- A. Clean locker interiors and exterior surfaces.

### **END OF SECTION**

## **SECTION 10 73 16.13 METAL CANOPIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Freestanding metal canopies.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings.
- B. Section 09 91 13 - Exterior Painting: Finish coating.
- C. Section 26 31 00 - Photovoltaic Collectors: Integrated solar panels.

#### **1.03 REFERENCE STANDARDS**

- A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- E. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- F. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- G. ASTM E2950 - Standard Specification for Metal Canopy Systems.
- H. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- J. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- L. ITS (DIR) - Directory of Listed Products.
- M. NFPA 70 - National Electrical Code.
- N. UL (DIR) - Online Certifications Directory.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

- C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.
- D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.
- E. Manufacturer's Qualification Statement.
- F. Erector's Qualification Statement.
- G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Perform steel work in accordance with AISC 303.
  - 1. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
  - 1. Not less than three years of documented experience.
- C. Erector Qualifications: Company specializing in performing the work of this section.
  - 1. Not less than three years of documented experience and approved by canopy manufacturer.
- D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver materials to project site ready for erection.
- C. Package using methods that prevent damage during shipping and storage on site.
- D. Store materials under cover and elevated above grade.

#### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.
- C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Metal Canopies:

1. Basis of Design Product: Pre-Engineered Canopy, indicated on Drawings as manufactured by M Bar C Construction, Inc., or approved equal.
2. CityScapes Inc; \_\_\_\_\_: [www.cityscapesinc.com/#sle](http://www.cityscapesinc.com/#sle).
3. Kingspan Light + Air, LLC; Briteway: [www.kingspanlightandair.us/#sle](http://www.kingspanlightandair.us/#sle).
4. Mapes Industries; Super Lumideck: <https://mapes.com/#sle>.
5. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 METAL CANOPIES**

- A. Shop Fabricated Metal Canopy
  1. Pre-engineered steel system complying with ASTM E2950.
- B. Configuration: Layout and dimensions, column layout, canopy clearance, fascia profile, and roof covering design as indicated on drawings.
  1. Installation: Freestanding.
  2. Column Anchorage: Column baseplates installed with anchor bolts or expansion anchors into concrete footing, slab, or pier.
  3. Structural Framing System: Steel.
  4. Covering Material: Steel.
  5. Drainage Concept: Water collected in decking conducted into perimeter drain beams and discharged through columns.
- C. Performance Requirements:
  1. Design and fabricate metal canopy system to resist wind, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:
    - a. Loads: As indicated on drawings.
  2. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.
  3. Electrical Components, Devices, and Accessories: Listed and labeled by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction and installed in compliance with NFPA 70, and marked for intended application.

## **2.03 COMPONENTS**

- A. Structural Steel Framing:
  1. Columns: ASTM A500/A500M, Grade B, round or rectangular tubing, sized to suit project design load requirements.
  2. Base and Top Plates: ASTM A36/A36M, with pre-drilled bolt holes.
  3. Beams: Wide flange, ASTM A572/A572M Grade 50.
  4. Other Structural Steel Members: ASTM A36/A36M.
- B. Covering:
  1. Steel Decking: Interlocking panels.

- a. Panel Size: 16 inches wide by 3 inches deep; 20 gauge, 0.0359 inch thickness.
  - b. Material: ASTM A653/A653M, G90 galvanized according to ASTM A924/A924M.
  - c. Provide canopy manufacturer's standard clip type fasteners for attaching covering to structural beams.
- 2. Overhang: 4 inches.
- C. Fascia: Manufacturer's standard perforated profile.
  - 1. Material: Galvanized steel panel laminated to 2 inch polystyrene foam core.
- D. Anchor Bolts: ASTM A307 or ASTM A572/A572M, formed with bent shank, assembled with template for casting into concrete.
  - 1. Minimum exposed thread of 7 inches above footing and 23 inch minimum embedment.
  - 2. Provide nuts and washers as required for column leveling and plumbing.
- E. Concrete Footings: Refer to Section 03 30 00 for additional requirements.
- F. Exposed Gutters and Downspouts: Galvanized steel with baked enamel finish, color to match canopy covering, manufacturer's recommended size for canopy specified.

#### **2.04 SHOP FABRICATION**

- A. Provide a complete system ready for erection at project site.
- B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.
- C. Weld steel members in accordance with AWS D1.1/D1.1M.
- D. Fabricate connections for bolt, nut, and washer connectors.

#### **2.05 FINISHES**

- A. Structural Steel Framing:
  - 1. Shop Primer: Rust-inhibitive red oxide.
  - 2. Finish Coating: As specified in Section 09 91 13.
- B. Steel Decking and Roofing: Polyester baked enamel finish; color as selected from manufacturer's standard range.
- C. Fascia: Polyester baked enamel finish; color as selected from manufacturer's standard range.

#### **2.06 ACCESSORIES**

- A. Structural Bolts: ASTM F3125/F3125M, Grade A325, minimum 3/4 inch diameter.
- B. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as sheet metal decking; factory-fabricated to required profiles.
  - 1. Exposed Fasteners: Not permitted.
- C. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.
- D. Fasteners, Non-Structural: ASTM F593 stainless steel or ASTM A307 carbon steel.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and site area for conditions that might prevent satisfactory installation.
- B. Verify that foundation, electrical utilities, and placed anchors are in correct position.
- C. Verify that bearing surfaces are ready to receive this work.
- D. Do not proceed with installation until all conditions are satisfactory.

### **3.02 INSTALLATION - FRAMING**

- A. Erect framing in accordance with AISC 303.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Fasten columns to anchor bolts.
- E. Do not field cut or alter structural members without approval.
- F. After erection, prime welds, abrasions, and surfaces not shop primed.

### **3.03 INSTALLATION - CANOPY COVERING**

- A. Install in accordance with manufacturer's instructions.
- B. Fasten metal decking to metal support members, aligned level and plumb.
- C. Install fascia panels, trim, and flashing.
- D. Separate dissimilar metals using concealed bituminous paint.
- E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

### **3.04 TOLERANCES**

- A. Maximum Variation from Level: Plus/Minus 1/8 inch.

### **3.05 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

### **3.06 PROTECTION**

- A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

**END OF SECTION**

## **SECTION 10 75 00 FLAGPOLES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Aluminum Flagpoles.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Owner furnished products; flags.
- B. Section 03 30 00 - Cast-in-Place Concrete: Concrete base and foundation construction.
- C. Section 31 23 16 - Excavation: Foundation earthwork.

#### **1.03 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
- C. ADA Standards - 2010 ADA Standards for Accessible Design.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- G. CBC Ch. 11B - California Building Code-Chapter 11B.
- H. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations for each type of flagpole required. Include data for fittings and accessories.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.
- D. Calculations: Submit engineering calculations and design for flagpole foundation assembly and pole per loads of CBC Chapter 16A.
  - 1. Design criteria as appropriate to the locale of the Project: NAAMM FP 1001 .
  - 2. Furnish calculations and drawings in a form acceptable to Architect.
  - 3. Calculations and foundation design shall be prepared and signed by a civil or structural engineer currently registered to practice in the State of California.

- E. Certificate: Submit professional structural engineer's certification that design complies with requirements of the contract documents.
- F. Manufacturer's Instructions: Submit for each product specified in this section. Include instructions for examination, preparation, and protection of adjacent work.
- G. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules and cleaning.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Firm regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.
- B. Installer's Qualifications: Firm regularly engaged, for the preceding five years, in the installation of flagpoles of equivalent type and physical characteristics to those required. If requested by Architect submit verifiable list of not less than five projects of equivalent type successfully completed within the preceding two years.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Flagpoles:
  - 1. Baartol Company, Inc., a division of Eder Flag Mfg. Co. Inc.; Architectural Series, Model EC("height"): [www.ederflag.com](http://www.ederflag.com)
  - 2. Concord Industries, Inc: [www.concordindustries.com](http://www.concordindustries.com).
  - 3. Flagpole Warehouse Division of The Flag Company, Inc.: [www.flagpolewarehouse.com](http://www.flagpolewarehouse.com).
  - 4. Morgan Francis Flagpoles & Accessories: [www.morgan-francis.com](http://www.morgan-francis.com).
  - 5. Pole-Tech Co., Inc: [www.polettech.com](http://www.polettech.com).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 FLAGPOLES**

- A. Flagpoles: Designed in accordance with NAAMM FP 1001.
  - 1. Material: Aluminum.
  - 2. Design: Cone tapered.
  - 3. Mounting: Ground mounted type.
  - 4. Outside Butt Diameter: 6 inches.
  - 5. Outside Tip Diameter: 3.5 inches.
  - 6. Nominal Wall Thickness: 0.188 inches.



7. Nominal Height: 25 and 30 ft; measured from nominal ground elevation.
  8. Halyard: Internal type, electric operation.
- B. Performance Requirements:
1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 110 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.
- C. Pole Construction: Construct pole and ship to site in one piece if possible. If more than one piece is necessary, provide snug- fitting, precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight hairline field joints.

### **2.03 POLE MATERIALS**

- A. Aluminum: ASTM B221 (ASTM B 221M) , 6063 alloy , T6 temper.

### **2.04 ACCESSORIES**

- A. Finial Ball: Aluminum, 6 inch diameter, Gold anodized.
- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. Winged Cleats: 9 inch size, aluminum with stainless steel fastenings, one per halyard.
1. Locate top of cleats maximum 47 inches above finish walking surface.
  2. Comply with CBC 11B-308, ADA Standards, and 36 CFR 1191.
    - a. DSA Note: A typical winged cleat, completely within 48 inches of the finish surface, is interpreted to meet the accessibility requirement of CBC Ch. 11B-309.4.
- D. Halyard: 5/16 inch diameter nylon, braided, white.
1. Provide 2 continuous halyards for each flagpole
  2. Halyard Flag Snaps: Provide 2 swivel snaps per halyard, chromium-plated bronze.
- E. Connecting Sleeve For Multiple Section Poles: Same material as pole, precision fit for field assembly of pole, concealed fasteners.
- F. Primer: Zinc chromate type.

### **2.05 MOUNTING COMPONENTS**

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gage, 0.0598 inch steel, galvanized, depth of 38-1/2 inches as indicated.
1. Steel centering wedges: Minimum 1/8 inch thick wedges, welded to sleeve plate inside foundation sleeve for the purpose of centering pole.
- B. Pole Base Attachment: Flush; steel base with base cover.
1. Foundation support plate: Square steel plate welded to electrical grounding spike at base of concrete foundation.
    - a. Minimum edge dimension of square plate: 6-inches.
    - b. Minimum thickness: 3/16 inch.
  2. Provide manufacturer's standard flash collar, finished to match flagpole.
- C. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

## **2.06 FINISHING**

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.
- B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.
- C. Aluminum: Mill finish.
- D. Finial: Gold anodized finish.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify an adjacent 30 x 48 inch clear firm, stable and level surface area for clear access. CBC Ch. 11B and ADA Standards.

### **3.02 PREPARATION**

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

### **3.03 INSTALLATION**

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1 inch.

### **3.05 ADJUSTING**

- A. Adjust operating devices so that halyard and flag function smoothly.

**END OF SECTION**

## **SECTION 11 11 36 VEHICLE CHARGING EQUIPMENT**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Electric vehicle charging units.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for pedestal-mounted charging units.

#### **1.03 REFERENCE STANDARDS**

- A. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. NFPA 70 - National Electrical Code.
- C. SAE J1772 - SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler.
- D. UL 2202 - Standard for Electric Vehicle (EV) Charging System Equipment.
- E. UL 2231-1 - Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements.
- F. UL 2231-2 - Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems.
- G. UL 2594 - Standard for Electric Vehicle Supply Equipment.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate this work with other installers to provide required electric power for specified charging units and accessory equipment being installed at designated locations.
  - 2. Coordinate this work with other installers to provide readily accessible location for disconnection as indicated and as required by NFPA 70.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents, and obtain documented directions before proceeding with this work.
- B. Manufacturer's charges associated with providing Cloud-Based Services subscriptions as necessary for charging unit operation to be paid by Owner.
- C. Preinstallation Meetings:
  - 1. Conduct meeting with facility representatives to review charging unit and accessory equipment locations, and require attendance by each affected installer.
- D. Sequencing: Do not install charging unit until final surface finishes and painting are complete.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Submit manufacturer's standard catalog and data sheets for charging units and installed accessories; include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Manufacturer's Installation Instructions: Submit necessary application conditions and limitations of use stipulated by product testing agency; include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- D. Manufacturer's detailed field testing procedures.
- E. Field quality control test reports.
- F. Maintenance Contracts.
- G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
  - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company with minimum three years documented experience with similar charging units; manufacturer's authorized installer.
- C. Maintenance Contractor Qualifications: Same entity as installer.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Maintain at project site a copy of each referenced document that prescribes execution requirements.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum three year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Electric Vehicle Charging Units:
  - 1. Enel X North America, an Enel Group company; JuiceBox Pro 40 with JuiceNet: [www.evcharging.enelx.com](http://www.evcharging.enelx.com).
  - 2. Enel X North America, an Enel Group company; JuicePedestal with JuiceNet: [www.evcharging.enelx.com](http://www.evcharging.enelx.com).
  - 3. Substitutions: Not permitted.
  - 4. Source Limitations: Furnish electric vehicle charging units and accessory equipment produced by single manufacturer and obtained from single supplier.

### **2.02 ELECTRIC VEHICLE CHARGING UNITS**

- A. Provide electric vehicle charging units in compliance with CEC (NFPA 70) and including required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides functional intent indicated.
- B. General Requirements:
  - 1. Listed and labeled as complying with UL 2594 or UL 2202.
  - 2. Provide personnel protection in accordance with UL 2231-1 and UL 2231-2.
  - 3. Enclosure Environment Type: In compliance with NEMA EN 10250, Type 3R or Type 4, unless otherwise indicated.
  - 4. Codes and Standards: FCC Part 15 Class B, NEC 625 compliant, ENERGY STAR®\*.
    - a. OCPP 1.6J and OpenADR 2.0b compliant
- C. Electric Vehicle Charging Unit JuiceBox Pro 40:
  - 1. Configuration: Single port, wall mount.
  - 2. Input: 2.5-foot input cable with NEMA 14-50 plug, OR 2.5-foot hardwire pigtail.
  - 3. Charging: AC Level 2 with SAE J1772 connector(s).
  - 4. Cable Length: 25 feet.
  - 5. Power Output: 9.6 kW per port, at 208-240 VAC, 40A.
  - 6. Network Connectivity: Cellular wide area network (WAN), Wi-Fi local area network (LAN); support remote station monitoring and configuration.
  - 7. Software:
    - a. Support management of driver authentication, payment methods, and pricing models.
    - b. Allow driver to access station availability and status.
  - 8. Dimensions: H: 18.5 in (469 mm) x W: 6.8 in (173 mm) x D: 5.8 in (147 mm).
  - 9. Weight: 15 lbs (6.8 kg).
  - 10. Features:
    - a. Integral surge protection.

- b. Locking holster(s).
- D. Electric Vehicle Charging Unit JuicePedestal LTE:
  - 1. Configuration: Dual port, pedestal mount.
  - 2. Input: 2.5-foot input cable with NEMA 14-50 plug, OR 2.5-foot hardwire pigtail.
  - 3. Charging: AC Level 2 with SAE J1772 connector(s).
  - 4. Cable Length: 20 feet.
  - 5. Power Output: 9.6 kW per port, at 208-240 VAC, 48A.
  - 6. Network Connectivity: Cellular wide area network (WAN), Wi-Fi local area network (LAN); support remote station monitoring and configuration.
  - 7. Software:
    - a. Support management of driver authentication, payment methods, and pricing models.
    - b. Allow driver to access station availability and status.
  - 8. Dimensions:
    - a. Height: 74 in/188 cm
    - b. Width: 19.88 in/50.50 cm by 8.00 in /20.32 cm deep
    - c. Weight: 175 lbs/79.38 kg (without charging units- add 15-17 lbs/6.80-7.71 kg per JuiceBox)
  - 9. Features:
    - a. Integral surge protection.
    - b. Locking holster(s).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of charging units are consistent with indicated requirements.
- C. Verify that charging unit locations indicated are free from obstructions and meet manufacturer's minimum clearance requirements.
- D. Verify that mounting surfaces are ready to receive charging units.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to charging units.
- F. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Construct cast-in-place concrete bases for pedestal-mounted charging units in accordance with Section 03 30 00.
- C. Install charging units plumb and level.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Program system parameters according to requirements of Owner.
- E. Confirm network connectivity.
- F. Test system for proper operation.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Submit detailed reports indicating inspection and testing results and corrective actions taken.

### **3.04 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### **3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

### **3.06 PROTECTION**

- A. Protect installed system components from subsequent construction operations.

### **3.07 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a separate maintenance contract for service and maintenance of charging units for one year from Date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

- C. Provide trouble call-back service upon notification by Owner:
  - 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  - 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

**END OF SECTION**



## **SECTION 11 30 13 APPLIANCES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Kitchen appliances.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 41 00 - Architectural Wood Casework: Adjacent cabinets for built-in fixtures.
- B. Section 07 92 00 - Joint Sealants.
- C. Division 22 - Plumbing: Water supply, and sanitary drainage and vent piping and specialties.
- D. Division 22 - Plumbing: Faucets and fittings; specialty food service fixtures.
- E. Electrical 26 - Equipment Wiring: Rough in and wiring of electrical equipment to building distribution.

#### **1.03 REFERENCE STANDARDS**

- A. CEC - California Electrical Code.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems.
- D. UL (DIR) - Online Certifications Directory.
- E. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of equipment specified.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Configuration, sizes, materials, finishes, locations, utility connections and locations.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Project Record Documents: Record actual locations of utility connections.

- F. Operation and Maintenance Data: Provide maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides; include instructions for maintenance of stainless steel fabrications and components and simplified diagrams for equipment as installed.
- G. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Extra Materials:
  - 1. Provide 1 year supply of air-purification (refrigerator unit) cartridge filters, minimum 2 units.
  - 2. Provide 1 year supply of ice-maker (freezer unit) water filters, minimum 2 units.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

#### **1.07 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for utility requirements.
- B. Products Requiring Electrical Connection: Listed and classified by UL (EAUED) as suitable for the purpose specified and indicated.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Store products clear of floor in a manner to prevent damage.
- B. Coordinate size of access and route to place of installation.

#### **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

### **PART 2 PRODUCTS**

#### **2.01 KITCHEN APPLIANCES**

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Refrigerator: Free-standing, side-by-side, and frost-free.
  - 1. ADA Standards Compliant
  - 2. Capacity: Total minimum storage of 23.3 cubic ft capacity.
  - 3. Features: Include glass shelves.
  - 4. Exterior Finish: Porcelain enameled steel, color as indicated.
  - 5. Mounting Installation: Standard (24 inches deep)

6. Electrical: 120V, 15A dedicated circuit, single phase, 3-wire grounded.
7. Accessories:
  - a. Replacement Air Filter Cartridge: see "Extra Materials" above in "Submittals".
8. Manufacturers (Owner Selection):
  - a. Frigidaire Home Products: [www.frigidaire.com](http://www.frigidaire.com).
  - b. GE Appliances: [www.geappliances.com](http://www.geappliances.com).
  - c. Whirlpool Corp: [www.whirlpool.com](http://www.whirlpool.com).
  - d. Sub-Zero, Inc.: [www.subzero.com](http://www.subzero.com).
  - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Microwave: Pull-Out Drawer.
  1. ADA Standards Compliant
  2. Capacity: 1.5 cubic ft.
  3. Power: 1000 watts.
  4. Features: Include turntable and 2-speed exhaust fan.
  5. Exterior Finish: Black.
  6. Manufacturers:
    - a. Bosch; 800 Series - Stainless Steel HMD8451UC: [www.bosch-home.com](http://www.bosch-home.com)
    - b. Frigidaire Home Products: [www.frigidaire.com](http://www.frigidaire.com).
    - c. GE Appliances: [www.geappliances.com](http://www.geappliances.com).
    - d. Sharp; Microwave Drawer, SMD2480CS: [www.sharppusa.com](http://www.sharppusa.com).
    - e. Whirlpool Corp: [www.whirlpool.com/#sle](http://www.whirlpool.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Lay out work in advance to prevent damage to building, piping, wiring, or equipment; cut, fit, and patch where necessary; coordinate work with others.
- B. Verify ventilation outlets, service connections, and supports are correct and in required location.
- C. Verify utility rough-ins are provided and correctly located.
- D. Verify that electric power is available and of the correct characteristics.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Insulate to prevent electrolysis between dissimilar metals.
- C. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

- D. Do not cut or fit units in the field; if adjustments are necessary due to inadequate field measurement prior to fabrication, take unit back to shop and perform modifications there.
- E. Anchor built-in equipment in place.
- F. Follow SMACNA (SRM) seismic restraint recommendations for project location.
- G. Make sanitary joints between equipment and flashings and adjacent walls, floor, and ceiling, in accordance with Section 07 92 00 - Joint Sealants.

### **3.03 ADJUSTING**

- A. Adjust equipment and apparatus to ensure proper working order and conditions.
- B. Adjust equipment to provide efficient operation.
- C. Remove and replace equipment creating excessive noise or vibration.

### **3.04 CLEANING**

- A. Remove packing materials from equipment and properly discard.
- B. Remove masking or protective covering from stainless steel and other finished surfaces.
- C. Wash and clean equipment.
- D. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

### **3.05 CLOSEOUT ACTIVITIES**

- A. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.
  - 1. Test equipment prior to demonstration.
  - 2. Individual Performing Demonstration: Fully knowledgeable of all operating and service aspects of equipment.

### **3.06 PROTECTION**

- A. Remove protective coverings from prefinished work.
- B. Protect finished work from damage.

**END OF SECTION**

## **SECTION 12 24 00 WINDOW SHADES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Interior manual roller shades.
- B. Interior motorized roller shades.
- C. Motor controls.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 26 Electrical: Finish requirements for wall controls specified in this section.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- C. CBC Ch. 11B - California Building Code-Chapter 11B.
- D. CBC Chapter 11B - California Building Code-Chapter 11B.
- E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- F. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- I. WCMA A100.1 - Safety of Window Covering Products.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
  - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- C. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
  - 2. Do not install shades until final surface finishes and painting are complete.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
  - 1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
  - 1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
- D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- F. Selection Samples: Include fabric samples in full range of available colors and patterns.
- G. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- K. Maintenance contracts.

### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum three years of documented experience with shading systems of similar size and type.
  - 1. Manufacturer's authorized representative.
  - 2. Factory training and demonstrated experience.

### **1.07 MOCK-UP**

- A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
  - 1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
  - 2. Full-sized mock-up may become part of the final installation.

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

## **1.09 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

## **1.10 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
  - 1. Shade Hardware: One year.
  - 2. Fabric: One year.
  - 3. Aluminum and Steel Coatings: One year.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Interior Manually Operated Roller Shades:
  - 1. Draper, Inc; Clutch Operated FlexShade: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
    - a. Local Contact: Kathy Greenway. 951.304.9286.
  - 2. Hunter Douglas Architectural: [www.hunterdouglasarchitectural.com/#sle](http://www.hunterdouglasarchitectural.com/#sle).
  - 3. MechoShade Systems LLC: [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
  - 4. Skyco Shading; [www.skycoshade.com](http://www.skycoshade.com).
  - 5. SWFcontract, a division of Springs Window Fashions, LLC.: [www.swfcontract.com/#sle](http://www.swfcontract.com/#sle).
  - 6. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 ROLLER SHADES**

- A. General:
  - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
  - 2. Provide shade system that operates smoothly when shades are raised or lowered.
  - 3. Manual Window Shade Controls:
    - a. Unless where exempt per CBC Chapter 11B-203.9 Employee Workstations, manual window shade controls in classrooms, assemblies and other areas are required to accessible per CBC Ch. 11B-205 Operable Parts.
  - 4. Operation to comply with CBC Ch. 11B-309 Operable Parts.
    - a. Operable parts and controls at unobstructed forward and side approach shall be located within 48" a.f.f. to top of device. For reach requirements at other conditions, comply with CBC Ch. 11B-308 as they apply.

- b. Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist and shall have a maximum operable force of 5 lbs.
  - c. Operable parts shall also comply with CBC Ch. 11B-308.2, 11B-308.3. and 11B-309.4.
- B. Roller Shades:
  - 1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    - a. Drop Position: Regular roll.
    - b. Mounting: Wall mounted.
    - c. Size: As indicated on drawings.
    - d. Fabric: As indicated under Shade Fabric article.
  - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    - a. Material: Stamped steel.
  - 3. Roller Tubes: As required for type of shade operation.
    - a. Material: Extruded aluminum, clear anodized finish.
    - b. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
  - 4. Hembars: Designed to maintain bottom of shade straight and flat.
    - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
  - 5. Manual Operation for Interior Shades:
    - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
    - b. Drive Chain: Continuous loop beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.
    - c. Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight.
    - d. Chain Retainer:
      - 1) Chain tensioning device complying with WCMA A100.1.
      - 2) Manufacturer's standard clip.
  - 6. Accessories:
    - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.
      - 1) Color: White.
      - 2) Profile: Square.
    - b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
    - c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.



- C. Roller Shades - Basis of Design: MechoShade Systems LLC; ElectroShade with iQ2-AC EDU, line voltage, 120 VAC: [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
1. Description: Single roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    - a. Drop Position: Regular roll.
    - b. Mounting: Ceiling mounted.
    - c. Size: As indicated on drawings.
    - d. Fabric: As indicated under Shade Fabric article.
  2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    - a. Material: Steel, 1/8 inch thick.
    - b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
  3. Roller Tubes:
    - a. Material: Extruded aluminum.
    - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
  4. Hembars: Designed to maintain bottom of shade straight and flat.
    - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
  5. Intelligent Encoded Electronic Drive System:
    - a. Line-Voltage EDU, 120 VAC:
      - 1) Audible Noise: 46 dBA or less measured 3 feet from motor unit, depending on motor torque.
    - b. Modes of Operation:
      - 1) Uniform Mode: Shades move only to defined intermediate stop positions to maintain aesthetic uniformity.
      - 2) Normal Mode: Shades move to defined intermediate stop positions plus any position between defined upper and lower limits.
      - 3) Maintenance Mode: Prevent shade from moving to newly commanded positions via dry contact or network control commands until EDU has been serviced or Maintenance Mode has been cleared or disabled.
    - c. Control Methods:
      - 1) Local isolated dry contact inputs support local switch control and third-party system integration without separate interface.
      - 2) Bidirectional network communication enables commanding operation of large groups of shades over common backbone.

- 3) Provide minimum of three customizable preset positions accessible over network connection and local dry contact control inputs.
  - 4) Provide minimum of 32 customizable preset positions, including three local switch presets, accessible via network commands.
6. Accessories:
- a. Ceiling Pockets: Premanufactured metal shade pocket with removable closure panel, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
  - b. Ceiling Pockets with Prewired Raceway: UL 325 listed, extruded aluminum shade pocket with removable closure panel and ceiling tile support, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
    - 1) Designed to accommodate installation of motor control and wiring accessories within pocket.
    - 2) Product: MechoShade Systems LLC; ElectroPocket; Model \_\_\_\_\_; [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
  - c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

### 2.03 SHADE FABRIC

- A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Manufacturers:
    - a. MechoShade Systems LLC; ThermoVeil Basket Weave - 1300 Series (5% open): [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
    - b. Mermet Corporation; E-Screen - 5%: [www.mermetusa.com/#sle](http://www.mermetusa.com/#sle).
    - c. Phifer, Inc; Style 2390 5%: [www.phifer.com/#sle](http://www.phifer.com/#sle).
    - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
    - e. For any product not identified as "Basis of Design", submit information as specified for substitutions.
  2. Material: Vinyl coated polyester.
  3. Performance Requirements:
    - a. California Code of Regulations, Title 19 Section 3.08. Provide a nonflammable material, or treated and maintained in a flame-retardant condition by means of a flame-retardant solution or process approved by the State Fire Marshal, as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8
    - b. Fire Performance: Class A per ASTM E84 or UL 723 Comply with CBC Section 803 and 806; Class A per NFPA 286,
    - c. Flammability: Pass NFPA 701 large and small tests.
    - d. Fungal Resistance: No growth when tested according to ASTM G21.
  4. Openness Factor: 5%.
  5. Roll Width: 72 inches.

6. Color: As indicated on Drawings.
7. Fabrication:
  - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
  - b. Battens: Full width of shade, enclose in welded shade fabric pocket.

## 2.04 MOTOR CONTROLS

- A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- B. Provide all components and connections necessary to interface with other systems as indicated.
- C. Digital Network Controls:
  1. Intelligent Motors and Devices: Identifiable over network without separate interface.
  2. Provide suitable interface modules as indicated or as required for connection to standard (nonintelligent) motors and devices.
  3. Capable of reprogrammed control without requiring wiring modifications.
  4. Capable of assigning shade motors to shade groups/sub-groups.
  5. Capable of storing programmable open and close limits and minimum of three intermediate preset stop positions for each shade.
  6. Capable of aligning adjacent shades within accuracy of plus/minus 0.25 inch.
  7. Provide 10 year nonvolatile power failure memory for system configuration settings.
  8. Basis of Design: MechoShade Systems LLC; MechoNet: [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
    - a. Low-voltage network utilizes standard Category 5/6 UTP cable; maximum of 4,000 feet, 250 nodes.
    - b. Network Interface Components:
      - 1) MechoNet Network Interface; MNI Series: Four configurable motor/EDU ports (models available for RJ45 or terminal block wiring); four configurable switch ports; one infrared (IR) remote control port; one configurable serial port for RS232/RS485 communication.
      - 2) IQ2 Dual Splitter: Two motor/EDU ports; two switch ports.
      - 3) IQ/MLC2 Motor Group Controller: Four ports for line-voltage standard (nonintelligent) motors (120 or 230 VAC; 600 W, 1/4 HP maximum).
- D. Manual Controls:
  1. Control Functions:
    - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
    - b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
    - c. Raise: Raise controlled shade(s) only while button is pressed.
    - d. Lower: Lower controlled shade(s) only while button is pressed.

- e. Presets: For selection of predetermined shade positions.
  - f. Multiple Shade Groups: Provide individual controls for each shade group as indicated.
- 2. Wall Controls: Provided by shade manufacturer.
  - a. Finish: To be selected by Architect.
  - b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.
- 3. Handheld Remote Controls: Battery-powered; wireless (radio frequency) or infrared; provided by shade manufacturer.
  - a. Wireless (Radio Frequency) Range: 30 feet.
  - b. Finish: To be selected by Architect.
  - c. Quantity: As indicated on drawings.
- E. Timeclock:
  - 1. Program Capability: Digital astronomic type, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days; automatically adjusts for seasonal changes in sunrise and sunset times.
  - 2. Provide automatic daylight savings time compensation.
  - 3. Provide power outage backup to retain programming and maintain clock.
- F. Automatic Solar-Tracking Controls:
  - 1. Calculates the sun's position in the sky relative to the building and then calculates when shade movement is necessary by facade/control zone.
  - 2. Calculates the position of the shade to limit direct sunlight penetration to a predetermined limit.
  - 3. Shades along same facade/control zone to align and start, stop, and track in unison to maintain a consistent aesthetic.
  - 4. Algorithms to include consideration of:
    - a. Building location.
    - b. Facade orientation.
    - c. Window dimensions.
    - d. Allowable solar depth of penetration.
  - 5. Override Capability:
    - a. Capable of automatic override of shade positions for:
      - 1) Dark conditions (e.g., cloudy), based on input from photosensor(s); shades to go to predetermined position to maximize occupant view and available daylight.
      - 2) Bright conditions, based on input from photosensor(s); shades to go to predetermined position to maximize occupant comfort.
      - 3) User-defined programmable schedule.
    - b. Capable of manual temporary override of shade positions using:
      - 1) Wall controls.

- 2) Software user interface.
6. Basis of Design: MechoShade Systems LLC; SolarTrac: [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
  - a. Solar Evaluation/Sky Modeling: Utilizes ASHRAE Clear Sky algorithms; sky model calculated daily.
  - b. System Capacity: Supports up to 65,000 zones/65,000 motors.
  - c. Shade Positioning: Capable of aligning shades at up to 256 positions; resolution calculated once every minute.
  - d. Provide the following control features:
    - 1) Brightness Override; enables automatic override of shade positions for bright conditions, based on input from photosensor(s) and user-defined allowable brightness ratio.
    - 2) Shadow Override; enables automatic override of shade positions for facade/zone in shadow due to adjacent structures (e.g., buildings, trees, etc.) as determined by three-dimensional model and user-defined timing parameters.
    - 3) Algorithms Override; IP-based software user interface over local area network enables control of individual shade motors, shade groups, or zones; administrative settings allow for assignment of shade control restrictions for specific users.
    - 4) Reflection Module; enables automatic override of shade positions for reflections from adjacent structures or features (e.g., buildings, bodies of water, etc.) as determined by three-dimensional model.
  - e. Browser User Interface: Utilizes interactive floor plan; supports zone/sensor monitoring, manual/master override, alerts/notifications, reports/analysis, multi-level user access.
  - f. Other Features: Event scheduler, data logging; integration with third-party systems via BACnet (BTL certified), Ethernet UDP, Ethernet TCP/IP, REST API, and RS485; configurable zone properties; management of multiple buildings through single user interface.
  - g. Accessories:
    - 1) Solar Radiometers: For rooftop measurement of sky conditions; provide quantity of three unless otherwise indicated.
    - 2) Sunrise/Sunset Sensors: For supplementing rooftop solar radiometers for accurate measurement of sky conditions during sunrise/sunset periods.
    - 3) MechoNet Wireless Daylight Sensors; window mullion-mounted for brightness override; photovoltaic power, requires no batteries or power wiring; communicates wirelessly to MechoNet Wireless Controller configured for SolarTrac mode.
    - 4) MechoNet Wireless Occupancy Sensors: Ceiling-mounted for occupancy/vacancy override; solar-powered with battery backup; communicates wirelessly to MechoNet Wireless Controller configured for SolarTrac mode.

- 5) MechoNet Wireless Controller: Manages communication with up to 16 EnOcean radio frequency (RF) devices.
- 6) Touchscreen Manual Override Panels: For manual temporary override of shade positions; enables manual control of shades via touchscreen interface with graphical map of shades for local area.
- 7) Low-Voltage Wall Controls; IQ Switch: For manual temporary override of shade positions; momentary dry contact switch enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.

## **2.05 ROLLER SHADE FABRICATION**

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
  1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
  2. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.
- D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

### **3.02 PREPARATION**

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

### **3.04 SYSTEM STARTUP**

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

### **3.05 CLEANING**

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.
- C. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

### **3.06 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
- C. Training: Train Owner's personnel on operation and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

### **3.07 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

### **3.08 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for two years from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

**END OF SECTION**

## **SECTION 12 36 00 COUNTERTOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinetwork. PL-1 & SSM-1
- B. Wall-hung counters.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 41 00 - Architectural Wood Casework.
- B. Section 09 21 16 - Gypsum Board Assemblies: Support framing, grounds, and concealed blocking.
- C. Division 22 - Plumbing: Sinks.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
- E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.
- F. NEMA LD 3 - High-Pressure Decorative Laminates.
- G. PS 1 - Structural Plywood.
- H. WI (MCP) - Monitored Compliance Program (MCP).

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation.
  - 1. Provide the information required by AWMAC/WI (NAAWS) Architectural Woodwork Standards.
  - 2. Provide a Woodwork Institute Certified Compliance Label on the first page of the shop drawings.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.



- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- H. Installation Instructions: Manufacturer's installation instructions and recommendations.
- I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification: Provide WI (MCP) inspection report and quality certification of completed work.
  - 1. Provide labels or certificates indicating that the installed work complies with AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
    - a. 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.
    - b. Provide a Woodwork Institute Certified Compliance Label on each Plastic Laminate, Solid Surface, and Solid Phenolic Core countertop.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
    - a. 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.
  - 5. 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 the bid.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.07 FIELD 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.

## **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for material defects.

## **PART 2 PRODUCTS**

### **2.01 COUNTERTOPS**

- A. Quality Standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate. PL-1
  - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
    - a. Manufacturers:
      - 1) Formica Corporation: [www.formica.com](http://www.formica.com).
      - 2) Lamin-Art, Inc: [www.laminart.com](http://www.laminart.com).
      - 3) Panolam Industries International, Inc.\Nevamar: [www.nevamar.com](http://www.nevamar.com).
      - 4) Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
      - 5) Substitutions: See Section 01 60 00 - Product Requirements.
    - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - c. NSF approved for food contact.
    - d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
    - e. Finish: Matte or suede, gloss rating of 5 to 20.
    - f. Surface Color and Pattern: As indicated on drawings.
  - 2. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch thick with raised radiused edge, integral coved backsplash with radiused top edge.
  - 3. Back and End Splashes: Same material, same construction.
  - 4. Fabricate in accordance with AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

- a. SSM-1 Basis of Design Product: Solid Surfacing as manufactured by Formica Corporation, or approved equal.
- b. Manufacturers:
  - 1) Formica Corporation: [www.formica.com](http://www.formica.com).
  - 2) Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
  - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
- d. NSF approved for food contact.
- e. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
- f. Color and Pattern: As indicated on drawings.
- 3. Other Components Thickness: 1/2 inch, minimum.
- 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; bullnosed edge.
- 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
- 6. Skirts: As indicated on drawings.
- 7. Fabricate in accordance with AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

## **2.02 MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- D. Cleaning Agents: Non-abrasive, soft-scrub type kitchen cleansers.
- E. Joint Sealant: Mildew-resistant silicone sealant, clear.

## **2.03 FABRICATION**

- A. Fabricate according to Architectural Woodwork Standards Custom Grade.
- B. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- C. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: 4 inches, unless otherwise indicated.

- D. Wall-Mounted Counters: Provide brackets and braces as indicated on drawings.
  - 1. Mounting: Surface.
  - 2. Finish: As selected from the manufacturer's standard range.
  - 3. Counter Support Bracket: Unless indicated otherwise on Drawings.
    - a. Basis of Design Product: EH-1818 and 2 x 2 x 1/8 inch aluminium angle Cleat Stock as manufactured by Rakks/Rangine Corporation, rakks.com, or approved equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
  - 1. Verify dimensions by field measurements prior to fabrication.
  - 2. Base Cabinets: Cabinet units shall be securely fixed to adjoining units and structure.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.
- D. Inspect finished surfaces for damage. Do not install until damage materials have been repaired in an acceptable manner or replaced.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Protect finished surfaces against scratches. Apply masking where necessary. Guard against grit, dust, and other trades.

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

### **3.04 TOLERANCES**

- A. Variation From Horizontal: 1/16 inch in 1/16 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.
  - 1. Joints between backsplashes and countertops: Seal joints with silicone sealer.

### **3.05 CLEANING**

- A. Remove masking and excess adhesives and sealants. Clean exposed surfaces.
- B. Clean countertops surfaces thoroughly.

### **3.06 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

## **SECTION 14 42 00 WHEELCHAIR LIFTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Vertical platform wheelchair lifts.
- B. Maintenance contract.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 26 - Electrical.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices.
- D. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- I. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- K. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
- L. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- M. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- O. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- P. CBC - California Building Code.
- Q. CBC Chapter 11B - California Building Code-Chapter 11B.
- R. ICC A117.1 - Accessible and Usable Buildings and Facilities.

- S. ITS (DIR) - Directory of Listed Products.
- T. NEMA MG 00001 - Motors and Generators.
- U. NFPA 70 - National Electrical Code.
- V. UL (DIR) - Online Certifications Directory.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate installation of wheelchair lift system with adjacent construction using necessary attachments; provide anchoring devices in accordance with manufacturer's installation instructions; coordinate installation of cast-in-place concrete components.
  - 1. Electrical System: Coordinate utility and electrical system connections to ensure they are made in an orderly and expeditious manner.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include data on material descriptions, construction details, component dimensions and profiles, and finishes; include data on rated capacities, electrical and operating characteristics, and necessary accessories.
- C. Shop Drawings: Include plans, elevations, sections, and attachment details; include equipment assembly details with dimensions, weights, loads, required clearances, components, size and location of anchors and required field connections, and methods for field assembly; provide diagrams indicating signal, power, and control wiring.
- D. Designer's qualification statement.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Testing agency's qualification statement.
- H. Maintenance contracts.
- I. Executed warranty.
- J. Project Record Documents: Accurately record actual locations of concealed items, conduits, and components.
- K. Maintenance Materials: Provide the following for Owner's use in maintenance of wheelchair lifts and equipment.
  - 1. See Section 01 60 00 - Product Requirements for additional provisions.
  - 2. Provide technical information for servicing operating equipment.
  - 3. Spare Parts: Provide parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
  - 4. Provide legible schematic wiring diagrams of installed electrical equipment and changes made to this part of work; list symbols corresponding to identity or markings on wheelchair lifts structural and electrical components.

## **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Provide wheelchair lift design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in California.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- E. Documents at Project Site: Maintain at project site one copy of manufacturer's installation instructions, erection drawings, shop drawings, and reference standard documents.

## **1.07 FIELD CONDITIONS**

- A. Use of wheelchair lifts during construction for hoisting materials or personnel is not permitted.

## **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty to repair or replace wheelchair lift system components that fail in materials or workmanship. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

# **PART 2 PRODUCTS**

## **2.01 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with ASME A18.1, ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
  - 1. California Elevator Safety Construction Code, California Code of Regulations, Title 8, Subchapter 6. Elevator Safety Orders.
- B. Accessibility Requirements: Comply with CBC Chapter 11B and ADA Standards
  - 1. Lifts, serving as an accessible means of egress, shall be provided with standby power or with self-rechargeable battery power that provides sufficient power to operate all platform lift functions for a minimum of 5 upward and downward trips. CBC Chapter 11B-207.2.
  - 2. Platform lifts shall not be attendant-operated and shall provide unassisted entry and exit from the lift. CBC Chapter 11B-410.1 General.
  - 3. Floor surfaces in platform lifts shall comply with CBC Chapter 11B302 and 11B-303.
  - 4. Clear floor space in lifts shall comply with CBC Chapter 11B-305.
    - a. The clear inside unobstructed platform dimensions for a straight through access shall be 36 x 54 inch minimum. CCR, Title 8, Section 3093.46(b)



- b. 90 Degree Side Approach: 42 x 60 inch minimum for 90 degree access. CCR Section 3094.2(p) 1-4.
    - 1) or 43 x 59 inches, 44 x 58 inches, 45 x 57 inches, 46 x 56 inches, 47 x 55 inches, 48 x 54 inches minimum.
- 5. The clearance between the platform sill and the edge of any runway landing shall be 1-1/4 inch maximum.
- 6. Controls for lifts shall comply with CBC Chapter 11B-309.
  - a. Operation of lifts from the landings and from the platforms shall be controlled by control switches at all stations, and shall be by means of the continuous-pressure type. CCR Title 8 Section 3094.2 (o) (1).
  - b. Controls shall be 48 inches maximum and 15 inches minimum above the platform floor or facility floor or ground level.
  - c. Operating devices shall be designed so that both the 'UP" and "DOWN" circuits cannot be operated at the same time. CCR Title 8 Section 3094.2 (o) (2) and ASME A18.1 Section 2.10.1.
- 7. Platform lifts shall have low-energy power doors or gates complying with CBC Chapter 11B-404.3.
  - a. Door shall remain open for 20 seconds minimum.
  - b. End doors and gates shall provide a clear width 32 inch minimum.
  - c. Side doors and gates shall provide a clear width 42 inch minimum.
    - 1) Exception: Lifts serving two landings maximum and having doors or gates on opposite sides shall be permitted to have self-closing manual doors or gates.
      - (a) Manual doors and gates shall provide level maneuvering clearances in conformance with CBC Chapter 11B-404.2.4.
  - d. Guards and lift doors at upper landing shall be 42 inch minimum.
- 8. Vertical wheelchair platform lifting device consisting of a machine tower with lifting platform to provide lifting height as indicated on drawings. CBC Chapter 11B-410 Platform Lifts.
  - a. Design for interior use with minimum 60 x 60 inch clear landing at each level per CBC Chapter 11B-410.7 Landing Size.
- 9. Provide signs conspicuously posted at each landing to indicate the following:
  - a. The International Symbol of Accessibility (ISA).
  - b. The lift shall not be used to transport freight materials or equipment.
  - c. A sign complying with CBC Sections:
    - 1) 11B-216.1 General;
    - 2) 11B-703.1 General;
    - 3) 11B-216.2 Designations
    - 4) 11B-703.2 Raised Characters
    - 5) 11B-703.3 Braille
    - 6) 11B-216.3 Directional and Informational Signs

- 7) 11B-703.5 Visual Characters
- 8) A restriction sign complying with CBC Chapter 11B-703.5 and ASME A18.1 Section 2.7.4.
  - (a) Securely fastened in a conspicuous place at each landing and on the platform.
  - (b) The sign shall state "No Freight" in letters not less than 5/8 inch high and include the International Symbol of Accessibility.
- d. The lift capacity (specify max. weight).
- e. The telephone number to call in case of emergency.
- 10. Lifts without a runway enclosure shall comply with the requirements of ASME A18.1 Section 2.1.3 which include, but are not limited to, the following:
  - a. Travel of platform lifts shall not exceed 5 feet per ASME A18.1, Section 2.7.1.
  - b. The runway entrance at the upper landing shall be guarded by an unperforated, self-closing door of at least 42 inches high, not wider than the entrance to the platform plus 1 inch.
    - 1) The lift side of the door and sill shall present a smooth surface.
    - 2) The door shall be located not more than 3 inches from the platform sill.
  - c. The runway entrance shall be guarded at any intermediate landing by an unperforated, self-closing door of at least 42 inches above the top terminal landing, not wider than the entrance to the platform plus 1 inch.
    - 1) The lift side of the door shall present a smooth surface.
    - 2) The door shall be located not closer than 3/8 inch or more than 3/4 inch from the access edge of the platform floor.
  - d. The lower landing side of the platform shall be guarded as follows:
    - 1) by an unperforated, self-closing platform door of at least 42 inch high in conformance with ASME A18.1 Section 2.1.3.4.1.
    - 2) or by a powered, retractable passenger restraining arm(s) in conformance with ASME A18.1 Section 2.1.3.4.2
  - e. The sides of platform not used for entrance or exit shall be guarded by walls of smooth construction with no openings, other than those necessary for operation of the lift, to a height of at least 42 inches. Openings necessary for operation shall reject a ball 1/2 inch in diameter.
    - 1) A grab bar or rail extending the full length of either sidewall of platforms shall be provided at a height of 34 to 38 inches.
    - 2) The running clearance between the platform enclosure walls and the machine housing or any other rigid surface shall be 2 inches minimum.
    - 3) Where an obstruction or surface less than 42 inches above the top landing other than the machine housing is within 12 inches of the platform enclosure walls, a smooth continuous surface shall be provided extending from the lower landing to a height of 42 inches minimum above the top landing.

- 4) Where an obstruction or surface is between 42 inches and 80 inches above the top landing, a smooth continuous surface shall be provided extending from the lower landing to a height of 3 inches minimum above the obstruction.
- f. The underside of the platform shall be guarded in accordance with the requirements of ASME A18.1 Section 2.1.3.6:
- g. The clearance between the platform floor and the upper landing sill shall be 3/8 inch minimum to 3/4 inch maximum. ASME A18.1 Section 2.1.3.7
- h. All doors shall be provided with a combination mechanical lock and electric contact. ASME A18.1 Section 2.1.3.8
- i. At locations where guards are not required at the upper landing as allowed by CBC Section 1013, lifts shall be permitted to comply with ASME A18.1 Sections 2.1.3.9 and 2.1.3.10.
- j. The sides of platform not used for entrance or exit shall be guarded by walls of smooth construction with no openings, other than those necessary for operation of the lift, to a height of at least 42 inches. Openings necessary for operation shall reject a ball 1/2 inch in diameter.
  - 1) A grab bar or rail extending the full length of either sidewall of platforms shall be provided at a height of 34 to 38 inches.
  - 2) The running clearance between the platform enclosure walls and the machine housing or any other rigid surface shall be 2 inches minimum.
  - 3) Where an obstruction or surface less than 42 inches above the top landing other than the machine housing is within 12 inches of the platform enclosure walls, a smooth continuous surface shall be provided extending from the lower landing to a height of 42 inches minimum above the top landing.
  - 4) Where an obstruction or surface is between 42 inches and 80 inches above the top landing, a smooth continuous surface shall be provided extending from the lower landing to a height of 3 inches minimum above the obstruction.
- k. The underside of the platform shall be guarded in accordance with the requirements of ASME A18.1 Section 2.1.3.6:
- l. The clearance between the platform floor and the upper landing sill shall be 3/8 inch minimum to 3/4 inch maximum. ASME A18.1 Section 2.1.3.7
- m. All doors shall be provided with a combination mechanical lock and electric contact. ASME A18.1 Section 2.1.3.8
- n. At locations where guards are not required at the upper landing as allowed by CBC Section 1013, lifts shall be permitted to comply with ASME A18.1 Sections 2.1.3.9 and 2.1.3.10.
- 11. Lifts with a runway enclosure shall comply with ASME A18.1 Section 2. 1.1. Travel of lifts shall not exceed 14 feet per ASME A18.1 Section 2.7.1.
- 12. Lifts with a partial runway enclosure shall comply with ASME A18.1 Section 2.1.2. Travel of lifts shall not exceed 14 feet per ASME A18.1 Section 2.7.1.

13. Lifts shall be permitted to have a pit. Unenclosed pits shall not exceed 4 inches high. Where a pit is not provided, a floor-mounted or retractable platform ramp shall be provided as follows in accordance with ASME A18.1 Sections 2.1.6.1 and 2.1.6.2: Note that all ramps greater than 6 inches in rise or greater than 72 inches in length are required to have handrails per CBC Chapter 11B-405.8
  - a. Floor mounted ramps — ramping inclinations shall be not greater than
    - 1) 1:8 for heights up to 3 inches.
    - 2) 1:10 for heights up to 4 inches.
    - 3) 1:12 for heights greater than 4 inches.
  - b. Retractable ramps — ramping inclinations shall be not greater than
    - 1) 1:4 for heights up to 2 inches.
    - 2) 1:6 for heights up to 2 1/2 inches.
    - 3) 1:8 for heights up to 3 inches.
    - 4) 1:10 for heights up to 4 inches.
    - 5) 1:12 for heights greater than 4 inches.
  - c. Retractable ramps shall be automatically actuated to a position of 70 degree minimum from horizontal and shall remain in their elevated position until the platform returns to the landing.
14. Vertical (wheelchair) lifts shall have a manual lowering device. The lowering device is for use by others to lower the lift to the lower landing should the lift downward motion become impaired. The lowering device shall comply with the following per CCR, Title 8, Section 3094.2(g).
  - a. The device shall be secured against unauthorized use.
  - b. The device shall be operable or accessible from outside the enclosure.
  - c. When necessary to access the runway to operate the device, an opening in the runway with a lockable cover/panel shall be provided. The opening and cover/panel shall comply with the following:
    - 1) The opening shall be of sufficient size and located to allow safe access and reach to the lowering device; and
    - 2) The cover/panel shall be kept locked and the key shall be available on the premises during normal business hours and after-school activity hours under the control of an authorized person.
- C. Structural Performance: Comply with ASCE 7 for loading of wheelchair lift components and assemblies.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Perform electrical work in accordance with NFPA 70.

## **2.02 VERTICAL PLATFORM WHEELCHAIR LIFTS**

- A. Manufacturers:
  1. Basis of Design Product: Clarity Model 16E, Straight-Through, Enclosed as manufactured by Ascension Lift, or approved equal.

2. Ascension Lift; Clarity, Model 16E, Straight-Through, Enclosed : [www.ascension-lift.com](http://www.ascension-lift.com).
  3. Garaventa Lift; Genesis Enclosure - Vertical Platform Lift: [www.garaventlift.com/#sle](http://www.garaventlift.com/#sle).
  4. Savaria: [www.savaria.com/#sle](http://www.savaria.com/#sle).
  5. Vertical Platform Lifts: [www.vertical-platform-lifts.com/#sle](http://www.vertical-platform-lifts.com/#sle).
  6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vertical Platform Wheelchair Lifts: Provide manufacturer's standard type that complies with indicated requirements. Use manufacturer's standard components for vertical platform wheelchair lifts as required for complete system unless otherwise indicated.
1. Type of Vertical Platform Wheelchair Lift:
    - a. Vertical platform wheelchair lift within factory-fabricated aluminum-framed wall enclosure, and integrated doors or gates.
  2. Configuration:
    - a. Straight through entry/exit, with front and rear openings.
    - b. Number of Stops: Two.
    - c. Landing Openings, Self-Closing:
      - 1) Lower landing with enclosure-mounted door.
      - 2) Upper landing with gate and platform mounted gate.
  3. Location:
    - a. Interior of building, as indicated on drawings.
  4. Lift Load Capacity: 750 lb, maximum.
  5. Lifting Height from Bottom to Upper Floor Level: As indicated on drawings.
  6. Platform Width Clearance: As indicated on drawings.
  7. Platform Length Clearance: As indicated on drawings.
  8. Platform Gate: Self-closing and flush-mounted, nominal height of 42 inches with width corresponding to width of platform.
  9. Platform Side Wall Panels: Nominal height of 42 inches, with clear plexiglass (standard) sheet panels, and enclosed within rectangular extruded aluminum framework.
  10. Platform Floor: Steel sheet with matte finish, having overall thickness not greater than 1-1/2 inches.
    - a. Flooring: Non-Slip.
  11. Drive System:
    - a. Roller chain hydraulic.
      - 1) Rated Speed: 20 fpm, nominal.
  12. Drive System Enclosure: Provide rectangular galvanized steel tube frame with flush steel sheet panels on sides and top to enclose drive system components; securely attach enclosure to adjacent substrate.
- C. Wall Enclosure Components: Prehung, non-fire-rated doors and gates suspended in structural framework with infill panels as indicated.

1. Doors and Gates: Self-closing type, with flush mount.
2. Doors: Aluminum frame with clear acrylic sheet infill panels.
3. Door Height: As indicated on drawings, at landings indicated.
4. Door Width: 36 inches, at landings indicated.
5. Upper Gate: Extruded aluminum frame with 16 gauge, 0.0598 inch galvanized steel sheet lower panel kick plate, and galvanized steel sheet upper panel.
6. Gate Height: 42 inches, at upper landing.
7. Gate Width: 36 inches, at upper landing.

## **2.03 ELECTRICAL CHARACTERISTICS AND COMPONENTS**

- A. Electrical Characteristics:
  1. 3 hp.
  2. 16 rated load amperes.
  3. 115 VAC, single-phase, 60 Hz.
  4. Battery Power: Two, 12 volts DC batteries, with 115 volts AC, single-phase, dedicated charging circuit.
  5. System wiring connections; see Division 26 - Electrical.
  6. System wiring devices; see Division 26 - Electrical.
- B. Platform Controls: Continuous pressure switch, one for each direction, with keyless operation.
- C. Attendant: Provide call device at each landing to contact attendant, if necessary.
- D. Geared Motor: Comply with NEMA MG 1.
- E. Motor Control: Inverter control and other components as required by manufacturer for system indicated.
- F. Disconnect Switch: Factory mount disconnect switch in control panel.
- G. Emergency Operation: Provide battery-powered system to raise or lower lift to landing due to malfunction or loss of power.
- H. Electrical Components, Boxes, Conduit, Wiring, and Devices: Comply with NFPA 70 and UL (DIR) or ITS (DIR) listed and labeled, and marked as applicable for proposed locations.

## **2.04 MATERIALS**

- A. Rolled Steel Sections, Shapes, and Rods: Comply with ASTM A36/A36M.
- B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Designation SS (structural steel), Grade 33 (230), with G90/Z275 coating.
- C. Rolled Steel Floor Plates: Comply with ASTM A786/A786M, 1/8 inch thick, with manufacturer's standard surface pattern; rolled from steel plate complying with ASTM A572/A572M, Grade 55 (380).
- D. Steel Tubing: Comply with ASTM A500/A500M, cold formed.
- E. Anchor Bolts and Rods: Comply with ASTM F1554, Grade 55.
- F. Welding: Comply with applicable requirements of AWS D1.1/D1.1M and AWS D1.3/D1.3M.

## **2.05 EQUIPMENT**

- A. Lubrication of Equipment: Provide grease fittings for lubricating bearings requiring periodic lubrication, automatic feed type grease cups, and visible and easily accessible lubrication points.
- B. Guide Rails, Ropes, Counterweights, Sheaves, Attachment Brackets, and Anchors: Sized in accordance with local building code, including safety factors.
- C. Maintenance Devices: Provide as necessary within wheelchair lift system, supported on structural members within accessible locations.

## **2.06 FINISHES**

- A. Baked-On Factory Finish for Structural Metal Surfaces: Clean surfaces of rust, oil, or grease and wipe clean with solvent; apply manufacturer's standard two-coat, baked-on finish consisting of primer and thermosetting top coat.
  - 1. Color: Black.
- B. Zinc Coated Hot-Dip Galvanized Iron and Steel Surfaces: Clean with neutralizing solvent, pretreat, and apply primer; for equipment comply with ASTM A123/A123M and hardware comply with ASTM A153/A153M.
  - 1. Color: Oil-rubbed bronze.
- C. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that areas and conditions comply with installation tolerances and other conditions affecting this work.
- B. Verify that locations for electrical rough-in connections to system equipment are in acceptable locations before installing equipment.
- C. Verify that electrical power is available and of correct characteristics.
- D. Verify that walls and floors for wheelchair lift areas are plumb and square, and properly sloped for drainage.
- E. Do not proceed with installation until unacceptable conditions have been corrected.

### **3.02 PREPARATION**

- A. Prepare surfaces of substrates using methods in accordance with lift manufacturer's installation instructions.
- B. Clean surfaces thoroughly before starting installation of lifts.

### **3.03 INSTALLATION**

- A. Install wheelchair lift system and components in accordance with manufacturer's written installation instructions.
- B. Install wheelchair lift system securely to supporting structure, and flush with adjacent surfaces.

- C. Install structural components using methods that comply with requirements indicated relative to layout and structural position.

### **3.04 ADJUSTING**

- A. Adjust wheelchair lift equipment to operate smoothly and safely.
- B. Verify vertical travel of wheelchair lift system; adjust as necessary to maintain operating range indicated.
- C. After installation, inspect exposed factory-finished wheelchair lift equipment and repair damaged finishes.

### **3.05 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components.

### **3.06 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training for additional requirements.
- C. Demonstration: Demonstrate operation of wheelchair lift system to Owner's personnel.
  - 1. Use operation and maintenance data as a reference during the demonstration.
  - 2. Briefly describe function, operation, and maintenance of each component.

### **3.07 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Provide a separate maintenance contract for service and maintenance of wheelchair lifts system and components for one year after Date of Substantial Completion.
- C. Perform maintenance work using competent personnel under supervision and in direct employment of wheelchair lift installer.
- D. Assigning or transfer of maintenance service to any agent or subcontractor is not permitted without prior consent of Owner.
- E. Examine monthly; clean, adjust, and lubricate equipment.
- F. Repair, or replace parts when required with parts produced by original equipment manufacturer.
- G. Provide emergency call back service 24 hours per day during maintenance period.

## **END OF SECTION**



**SECTION 22 05 00**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Equipment installation requirements common to equipment sections.
  - 7. Concrete bases.
  - 8. Supports and anchorages.

**1.02 DEFINITIONS**

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

**1.03 SUBMITTALS**

- A. Welding certificates.

**1.04 QUALITY ASSURANCE**

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## **PART 2 - PRODUCTS**

### **2.01 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### **2.02 JOINING MATERIALS**

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- E. Welding Filler Metals: Comply with AWS D10.12.

### **2.03 DIELECTRIC FITTINGS**

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

### **2.04 MECHANICAL SLEEVE SEALS**

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.

- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## **2.05 SLEEVES**

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## **PART 3 - EXECUTION**

### **3.01 PLUMBING DEMOLITION**

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.02 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

- B. 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.
- 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 to permit valve servicing.
- G. Install piping at indicated slopes.
- 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. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.03 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### **3.04 PIPING CONNECTIONS**

- A. 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 3 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### **3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### **3.06 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. 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 the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

### **3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES**

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### **3.08 ERECTION OF WOOD SUPPORTS AND ANCHORAGES**

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

END OF SECTION

**SECTION 22 05 16**  
**EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Flexible-hose packless expansion joints.
  - 2. Grooved-joint expansion joints.
  - 3. Alignment guides and anchors.
  - 4. Pipe loops and swing connections.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
  - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
  - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
  - 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

**1.04 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For expansion joints to include in maintenance manuals.

**1.05 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

## 2.02 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Flex Pression Ltd.
  - b. Flex-Hose Co., Inc.
  - c. Flexicraft Industries.
  - d. Mason Industries, Inc.
  - e. Metraflex Company (The).
2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
  - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
  - b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
  - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
  - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.
6. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.
  - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
  - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.
  - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
  - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.



## 2.03 GROOVED-JOINT EXPANSION JOINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Anvil International.
  - 2. Shurjoint Piping Products.
- B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
- C. Standard: AWWA C606, for grooved joints.
- D. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.
- E. Couplings: Seven, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water, and bolts and nuts.

## 2.04 ALIGNMENT GUIDES AND ANCHORS

- A. Alignment Guides:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flex-Hose Co., Inc.
    - b. Flexicraft Industries.
    - c. Flex-Weld, Inc.
    - d. Hyspan Precision Products, Inc.
    - e. Mason Industries, Inc.
    - f. Metraflex Company (The).
  - 2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.
- B. Anchor Materials:
  - 1. Steel Shapes and Plates: ASTM A 36/A 36M.
  - 2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
  - 3. Washers: ASTM F 844, steel, plain, flat washers.
  - 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
    - a. Stud: Threaded, zinc-coated carbon steel.
    - b. Expansion Plug: Zinc-coated steel.

- c. Washer and Nut: Zinc-coated steel.
- 5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
  - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
  - c. Washer and Nut: Zinc-coated steel.

## **PART 3 - EXECUTION**

### **3.01 EXPANSION JOINT INSTALLATION**

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.
- B. Install grooved-joint expansion joints to grooved-end steel piping.

### **3.02 PIPE LOOP AND SWING CONNECTION INSTALLATION**

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

### **3.03 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION**

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe, and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
  - 1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
  - 1. Anchor Attachment to Steel Structural Members: Attach by welding.

2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

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**SECTION 22 05 17**  
**SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

**2.02 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. 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: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

### **2.03 SLEEVE-SEAL FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Advance Products & Systems, Inc.
  2. CALPICO, Inc.
  3. Metraflex Company (The).
  4. Pipeline Seal and Insulator, Inc.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

### **2.04 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**

### **3.01 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.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  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 078400 "Firestopping."

### **3.02 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.

### **3.03 SLEEVE-SEAL-FITTING INSTALLATION**

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

### **3.04 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron 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-on-Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron 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.

END OF SECTION

**SECTION 22 05 18**  
**ESCUTCHEONS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

**2.02 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**

**3.01 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 or split-casting brass type with polished, chrome-plated finish.



- c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
  - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
  - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
  - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
  - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
  - j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
  - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
2. Escutcheons for Existing Piping:
- a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
  - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
  - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
  - g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
  - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
  - i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
  - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.
- 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.

### **3.02 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

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**SECTION 22 05 19**  
**METERS AND GAGES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Thermometers.
  - 2. Gages.

**1.02 SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Palmer - Wahl Instruments Inc.
  - 2. Terice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum or brass, 7 inches long.
- C. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Safety Glass.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

**2.02 THERMOWELLS**

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

## **2.03 PRESSURE GAGES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Palmer - Wahl Instruments Inc.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  - 5. Winters Instruments.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
  - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
  - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
  - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
  - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
  - 6. Pointer: Red or black metal.
  - 7. Window: Laminated Safety Glass.
  - 8. Ring: 304 Stainless Steel.
  - 9. Accuracy: Grade B, plus or minus 1 percent of whole scale.
  - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
  - 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
  - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
  - 2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

## **PART 3 - EXECUTION**

### **3.01 THERMOMETER APPLICATIONS**

- A. Install liquid-in-glass thermometers in the outlet of each domestic, hot-water storage tank.
- B. Provide the following temperature ranges for thermometers:
  - 1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
  - 2. Domestic Cold Water: 30 to 130 deg F, with 2-degree scale divisions.

### **3.02 GAGE APPLICATIONS**

- A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.
- B. Install Liquid-filled-case-type pressure gages at suction and discharge of each pump.

### 3.03 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage.
- E. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.
- F. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

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**SECTION 22 05 23**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following general-duty valves:
  - 1. Copper-alloy ball valves.
  - 2. Bronze gate valves.
- B. See Division 22 piping Sections for specialty valves applicable to those Sections only.

**1.02 SUBMITTALS**

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

**1.03 QUALITY ASSURANCE**

- A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

**2.02 VALVES, GENERAL**

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and Smaller: Threaded ends, unless otherwise indicated.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- E. Valve Actuators:
  - 1. Handwheel: For valves other than quarter-turn types.



- 2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
- F. Extended Valve Stems: On insulated valves.
- G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- H. Valve Grooved Ends: AWWA C606.
  - 1. Solder Joint: With sockets according to ASME B16.18.
    - a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
  - 2. Threaded: With threads according to ASME B1.20.1.
- I. Valve Bypass and Drain Connections: MSS SP-45.

### **2.03 COPPER-ALLOY BALL VALVES**

- A. Manufacturers:
  - 1. Two-Piece, Copper-Alloy Ball Valves:
    - a. Conbraco Industries, Inc.; Apollo Div.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Hammond Valve.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
    - f. Watts Industries, Inc.; Water Products Div.
- B. Copper-Alloy Ball Valves, General: MSS SP-110.
- C. Two-Piece, Copper-Alloy Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

### **2.04 BRONZE GATE VALVES**

- A. Manufacturers:
  - 1. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
- B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.
- C. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

## **PART 3 - EXECUTION**

### **3.01 VALVE APPLICATIONS**

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Throttling Service: Ball valves.
- B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
  1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
  2. Gate Valves, NPS 2 ½ and Larger: Type 2, Class 150, bronze.
- D. Select valves, except wafer and flangeless types, with the following end connections:
  1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
  3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded ends.

### **3.02 VALVE INSTALLATION**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.
  2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  3. Lift Check Valves: With stem upright and plumb.

### **3.03 JOINT CONSTRUCTION**

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### **3.04 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.

END OF SECTION



**SECTION 22 05 29**  
**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.
- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

**1.02 DEFINITIONS**

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.03 PERFORMANCE REQUIREMENTS**

- A. Piping systems shall be braced to comply with the forces and displacements prescribed in ASCE 7-10 section 13.3 as defined in ASCE 7-10 section 13.6.8, 13.6.7, 13.6.5.6, and 2022 CBC, sections 1616A.1.24, 1616A.1.25 and 1616A.1.26.
- B. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

**1.04 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Equipment supports.
- C. Welding certificates.

### **1.05 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.02 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Carpenter & Paterson, Inc.
  - 3. ERICO/Michigan Hanger Co.
  - 4. Globe Pipe Hanger Products, Inc.
  - 5. Grinnell Corp.
  - 6. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### **2.03 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### **2.04 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Tolco Inc.
  - 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Pregalvanized or hot dipped.

- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## **2.05 THERMAL-HANGER SHIELD INSERTS**

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO/Michigan Hanger Co.
  - 3. PHS Industries, Inc.
  - 4. Pipe Shields, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## **2.06 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Hilti, Inc.
    - c. ITW Ramset/Red Head.

## **2.07 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## **2.08 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, 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**

### **3.01 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.
- F. 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 120 to 450 deg F pipes, NPS 4 to NPS 16, 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 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  - 6. 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.
  - 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  - 8. 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.
- G. 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 20.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. 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.
- I. 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. 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.
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. 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.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.



### 3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel 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 building structure.
- B. 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 above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners 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.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. 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.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 3 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.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
  - 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 according to 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.
- 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
- 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 inserts.
- 6. Insert Material: Length at least as long as protective shield.
- 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.03 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 smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### **3.04 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 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 contours of welded surfaces match adjacent contours.

### **3.05 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### **3.06 PAINTING**

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

END OF SECTION

## **SECTION 22 05 48**

### **VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Isolation pads.
  - 2. Isolation mounts.
  - 3. Restrained elastomeric isolation mounts.
  - 4. Freestanding and restrained spring isolators.
  - 5. Housed spring mounts.
  - 6. Elastomeric hangers.
  - 7. Spring hangers.
  - 8. Spring hangers with vertical-limit stops.
  - 9. Pipe riser resilient supports.
  - 10. Resilient pipe guides.
  - 11. Seismic snubbers.
  - 12. Restraining braces and cables.

##### **1.02 PERFORMANCE REQUIREMENTS**

- A. Seismic-Restraint Loading:
  - 1. In accordance with Section 1632 of Table 126-0 of Volume 2, Title 24, 2016.

##### **1.03 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated in accordance with Section 1632 of Table 126-0 of Volume 2, Title 24, 2016
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    - c. Preapproval and Evaluation Documentation: By HCAI an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- D. Welding certificates.
- E. Qualification Data: For professional engineer and testing agency.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

#### **1.04 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (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: 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 OPM number from HCAI, preapproved by ICC-ES, or preapproved 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 not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## **PART 2 - PRODUCTS**

### **2.01 VIBRATION ISOLATORS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. California Dynamics Corporation.
  - 2. Isolation Technology, Inc.
  - 3. Mason Industries.
  - 4. Vibration Isolation.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
  - 1. Resilient Material: Oil- and water-resistant neoprene.
- C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
  - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- D. Restrained Mounts: All-directional mountings with seismic restraint.
  - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
  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.
- G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
  2. Base: Factory drilled for bolting to structure.
  3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.
- H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. 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.
  2. Outside 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. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
  7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. 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.
  2. Outside 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. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
  8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- K. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- L. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## **2.02 VIBRATION ISOLATION EQUIPMENT BASES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. California Dynamics Corporation.
  2. Isolation Technology, Inc.



3. Mason Industries.
  4. Vibration Isolation.
- B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
    - a. Include supports for suction and discharge elbows for pumps.
  2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
  3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
    - a. Include supports for suction and discharge elbows for pumps.
  2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
  3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
  4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

### **2.03 SEISMIC-RESTRAINT DEVICES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper B-Line, Inc.; a division of Cooper Industries.
  2. Hilti, Inc.
  3. Mason Industries.
  4. TOLCO Incorporated; a brand of NIBCO INC.
  5. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by HCAI an agency acceptable to authorities having jurisdiction.
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. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- G. 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.
- H. 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.
- I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- J. 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. Minimum length of eight times diameter.
- K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## **2.04 FACTORY FINISHES**

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
  2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
  3. Baked enamel or powder coat for metal components on isolators for interior use.
  4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## **PART 3 - EXECUTION**

### **3.01 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.
- 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.

### **3.02 APPLICATIONS**

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by HCAI 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 will be adequate to carry present and future static and seismic loads within specified loading limits.

### **3.03 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION**

- A. Equipment Restraints:
  - 1. Install seismic snubbers on plumbing 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 inches.
  - 3. Install seismic-restraint devices using methods approved by HCAI an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by HCAI an agency acceptable to authorities having jurisdiction providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

- F. 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.
- G. 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.
- H. 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.

### **3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION**

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 15 Section "Domestic Water Piping" for piping flexible connections.

### **3.05 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. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
  11. Test and adjust air-mounting system controls and safeties.
  12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### **3.06 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.
- C. Adjust active height of sprint isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

**SECTION 22 05 53**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

**1.02 ACTION SUBMITTALS**

- 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.

**1.03 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**

**2.01 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. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
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 rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. 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.

D. 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.

## **2.02 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 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. 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.

### **2.03 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 partially cover 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 inches high.

### **2.04 STENCILS**

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Aluminum.
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

### **2.05 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.

### **2.06 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**

### **3.01 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.

### **3.02 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.03 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: Green.
    - b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:
  - a. Background Color: Green.
  - b. Letter Color: White.
3. Natural Gas Piping:
  - a. Background Color: Yellow.
  - b. Letter Color: Black.

#### **3.04 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.

#### **3.05 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

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**SECTION 22 07 00**  
**PLUMBING INSULATION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Sealants.
  - 5. Factory-applied jackets.
  - 6. Tapes.
  - 7. Securements.
- B. Related Sections include the following:
  - 1. Division 23 Section "HVAC Insulation."

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 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, equipment connections, and access panels.
- C. Field quality-control reports.

**1.03 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting 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 25 or less, and smoke-developed index of 50 or less.

## **2.01 INSULATION MATERIALS**

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. 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 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.

## **2.02 INSULATING CEMENTS**

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## **2.03 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 Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- C. ASJ Adhesive, and FSK and PVDC 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 Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.

## **2.04 SEALANTS**

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-76-8.
    - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Vimasco Corporation; 750.
  - 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.
- B. Available ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-76.
  - 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: White.

## **2.05 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. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## **2.06 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - 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. 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 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.

## **2.07 SECUREMENTS**

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.02 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and 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. 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.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer 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.
- 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.
- O. 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.



### **3.03 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 Division 07 Section "Penetration Firestopping" 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 Division 07 Section "Penetration Firestopping."

### **3.04 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, vessels, and equipment. 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.

### **3.05 MINERAL-FIBER INSULATION INSTALLATION**

#### **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 but 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.

### **3.06 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.

### **3.07 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION

**SECTION 22 11 16**  
**DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes domestic water piping inside the building.
- B. Water meters will be furnished and installed by utility company.
- C. See Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.
- D. See Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

**1.02 SUBMITTALS**

- A. Field quality-control test reports.

**1.03 QUALITY ASSURANCE**

- A. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

**PART 2 - PRODUCTS**

**2.01 PIPING MATERIALS**

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
  - 1. Copper Pipe and Fittings:
    - a. Manufacturers:
      - 1) Streamline.
      - 2) Cerro-Flow Products.
      - 3) Cambridge-Lee Industries.
      - 4) NIBCO.
      - 5) Elkhart Products Corporation.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

## **2.02 VALVES**

- A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Balancing and drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

## **PART 3 - EXECUTION**

### **3.01 EXCAVATION**

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

### **3.02 PIPE AND FITTING APPLICATIONS**

- 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 may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 22 Section "Facility Water Distribution Piping."
- E. Domestic Water Piping on Service Side of Water Meter inside the Building: Use the following piping materials for each size range:
  1. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
- F. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Hard copper tube, Type K; copper pressure fittings; and soldered joints.
- G. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
  1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

### **3.03 VALVE APPLICATIONS**

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  1. Shutoff Duty: Use gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  2. Throttling Duty: Use gate valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
  3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
  4. Drain Duty: Hose-end drain valves.

- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 3 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
  - 2. Install stop-and-waste drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

### **3.04 PIPING INSTALLATION**

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping," and drain valves and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

### **3.05 JOINT CONSTRUCTION**

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### **3.06 ROUGHING-IN FOR WATER METERS**

- A. Rough-in domestic water piping for water meter installation according to utility company's requirements.
- B. Water meters will be furnished and installed by utility.

### **3.07 HANGER AND SUPPORT INSTALLATION**

- A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - 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: MSS Type 49, spring cushion rolls, if indicated.
  - 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.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 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 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-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.
- 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.

### **3.08 CONNECTIONS**

- A. Install piping adjacent to equipment and machines to allow service and maintenance.
- B. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- C. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
  - 1. Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."



4. 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 3 and larger.

### **3.09 FIELD QUALITY CONTROL**

#### **A. Inspect domestic water piping as follows:**

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. 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:
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

#### **B. Test domestic water piping as follows:**

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. 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.
3. 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.
4. 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.
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.

### **3.10 CLEANING**

- A. Clean and disinfect potable domestic water piping using purging and disinfecting procedures prescribed by authorities having jurisdiction.
- B. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

- C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION

**SECTION 22 11 19**  
**DOMESTIC WATER PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following domestic water piping specialties:
  - 1. Vacuum breakers.
  - 2. Hose bibbs.
  - 3. Water hammer arresters.
  - 4. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

**1.04 QUALITY ASSURANCE**

- A. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

**PART 2 - PRODUCTS**

**2.01 VACUUM BREAKERS**

- A. Hose-Connection Vacuum Breakers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Chicago Faucets
    - b. Arrowhead Brass Products, Inc.
    - c. MIFAB, Inc.
    - d. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1001.
3. Body: Bronze, non-removable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

## **2.02 HOSE BIBBS**

### **A. Hose Bibbs HB-1 and HB-2:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Chicago Faucets
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Divisions of Smith Industries, Inc.
  - d. Acorn Engineering Co.
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough chrome finish.
10. Finish for Service Areas: Rough chrome finish.
11. Finish for Finished Rooms: Polished chrome finish.
12. Operation for Equipment Rooms: Operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include wall flange with each chrome- or nickel-plated hose bibb.

## **2.03 WATER HAMMER ARRESTERS**

### **A. Water Hammer Arresters WHA-1:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - b. MIFAB, Inc.
  - c. Watts Drainage Products Inc.
  - d. PPP. Inc.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## **2.04 TRAP-SEAL PRIMER VALVES**

- A. Supply-Type, Trap-Seal Primer Valves TP-1:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. MIFAB, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. PPP. Inc.
  2. Standard: ASSE 1018.
  3. Pressure Rating: 125 psig minimum.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: NPS 1/2 threaded, union.
  6. Gravity Drain Outlet Connection: NPS 1/2 threaded.
  7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
  4. Upon device installation, immediately document and provide to the District all certified test reports with data for submittal to the County of Los Angeles Health Department.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. 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.
- H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- I. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  1. Reduced-pressure-principle backflow preventers.
  2. Double-check backflow-prevention assemblies.
  3. Water pressure-reducing valves.
  4. Primary, thermostatic, water mixing valves.
  5. Supply-type, trap-seal primer valves.
- J. 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 Division 22 Section "Identification for Plumbing Piping and Equipment."

### **3.02 FIELD QUALITY CONTROL**

- A. Perform the following tests and prepare test reports:
  1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### **3.03 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

**SECTION 22 11 23**  
**FACILITY NATURAL-GAS PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.

**1.02 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig (3.45 kPa) or less.

**1.04 SUBMITTALS**

- A. The contractor shall submit complete data as hereinafter specified. Said data, assembled in individual brochures, shall be submitted in seven (7) copies. Each item shall be identified by the paragraph number and page number as shown in the Specifications. Brochures shall be clearly labeled with project name and Architectural project number. Should corrections be necessary, the Contractor shall resubmit within fifteen (15) calendar days after the submittals are returned by the Architect
- B. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

### **1.05 QUALITY ASSURANCE**

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

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- C. Protect stored PE pipes and valves from direct sunlight.

### **1.07 PROJECT CONDITIONS**

- A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
  - 1. Notify Architect Construction Manager Owner no fewer than five (5) working days in advance of proposed interruption of natural-gas service.
  - 2. Do not proceed with interruption of natural-gas service without Architect's Construction Manager's and Owner's written permission.

### **1.08 COORDINATION**

- A. Coordinate sizes and locations of actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

## **PART 2 – PRODUCTS**

### **2.01 PIPING MATERIAL**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.



4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
  5. Corrosion Control: Refer to Soil Corrosivity Study and Report for further requirements.
- B. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

## **2.02 PIPING SPECIALTIES**

- A. Appliance Flexible Connectors:
1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
  2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
  3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
  4. Corrugated stainless-steel tubing with polymer coating.
  5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
  6. End Fittings: Zinc-coated steel.
  7. Threaded Ends: Comply with ASME B1.20.1.
  8. Maximum Length: 72 inches ((1830 mm)).

## **2.03 JOINING MATERIALS**

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## **2.04 MANUAL GAS SHUTOFF VALVES**

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
1. CWP Rating: 200 psig (862 kPa).
  2. Threaded Ends: Comply with ASME B1.20.1.
  3. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
  4. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

- C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 200 psig (862 kPa).
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Bronze Plug Valves: MSS SP-78.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Homestead.
    - b. Walworth.
  - 2. Body: Bronze, complying with ASTM B 584.
  - 3. Plug: Bronze.
  - 4. Ends: Threaded, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 5. Operator: Square head or lug type with tamperproof feature where indicated.
  - 6. Pressure Class: 200 psig.
  - 7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Homestead Valve; a division of Olson Technologies, Inc.
    - b. Walworth.
  - 2. Body: Cast iron, complying with ASTM A 126, Class B.
  - 3. Plug: Bronze or nickel-plated cast iron.
  - 4. Seat: Coated with thermoplastic.
  - 5. Stem Seal: Compatible with natural gas.
  - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. Operator: Square head or lug type.
  - 8. Pressure Class: 200 psig.
  - 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

## **2.05 EARTHQUAKE VALVES**

A. Earthquake Valves: Comply with ASCE 25.

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 by one of the following: (Refer to plans for model number)
  - a. KOSO.
  - b. Pacific Seismic Products, Inc.
3. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
4. Maximum Operating Pressure: 0.5 psig (3.45 kPa).
5. Cast-aluminum body with stainless-steel internal parts.
6. Nitrile-rubber, reset-stem o-ring seal.
7. Valve position, open or closed, indicator.
8. Composition valve seat with clapper held by spring or magnet locking mechanism.
9. Level indicator.
10. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.

## **2.06 SLEEVES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

## **2.07 ESCUTCHEONS**

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

- C. One-Piece, Cast-Brass Escutcheons: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Escutcheons: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Escutcheons: With exposed-rivet hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

## **2.08 LABELING AND IDENTIFYING**

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

### **3.03 OUTDOOR PIPING INSTALLATION**

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 24 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Install fittings for changes in direction and branch connections.
- E. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.

### **3.04 INDOOR PIPING INSTALLATION**

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install escutcheons at penetrations of interior walls, ceilings, and floors.
  1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - d. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with exposed-rivet hinge and set screw.
    - f. Piping in Equipment Rooms: One-piece, cast-brass type.
    - g. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
    - h. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
  - K. 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 in Division 07 Section "Penetration Firestopping."
  - L. Verify final equipment locations for roughing-in.

- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Conceal pipe installations in walls, pipe spaces and, utility spaces, above ceilings.
  - 1. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- P. Connect branch piping from top or side of horizontal piping.
- Q. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- R. Do not use natural-gas piping as grounding electrode.

### **3.05 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install earthquake valves outside buildings according to listing.
- D. Install anode for metallic valves in underground PE piping.

### **3.06 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. 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.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.

3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### **3.07 HANGER AND SUPPORT INSTALLATION**

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
  2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
  3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
  4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
  5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).

### **3.08 CONNECTIONS**

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

### **3.09 LABELING AND IDENTIFYING**

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

### **3.10 PAINTING**

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

- B. Paint exposed, exterior metal piping and valves, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (flat).
    - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### **3.11 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

### **3.12 OUTDOOR PIPING SCHEDULE**

- A. Underground natural-gas piping shall be the following:
  - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.

### **3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)**

- A. Aboveground, branch piping 2 inch and smaller shall be the following:
  - 1. Schedule 40 Black Steel pipe with #150 Black Banded malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
  - 1. Schedule 40 Black Steel pipe with #150 Black Banded malleable-iron fittings and threaded joints.
- C. Piping Under buildings; NOT Permitted
- D. Galvanized steel pipe and fittings shall NOT be used.

### **3.14 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
  - 1. PE valves.
  - 2. NPS 2 (DN 50) and Smaller: Bronze plug valves.
  - 3. NPS 2-1/2 (DN 65) and Larger: Cast-iron, lubricated plug valves.



### **3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
  - 1. Semi-steel Lubricated plug valve.
- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:
  - 1. Semi-Steel flanged plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
  - 1. Semi-Steel lubricated plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be the following:
  - 1. Semi-steel flanged, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be the following:
  - 1. Bronze plug valve.

END OF SECTION

**SECTION 22 13 16**  
**SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following for soil, waste, vent and condensate piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
  - 3. Encasement for underground metal piping.
- B. Video taped sanitary waste piping

**1.02 DEFINITIONS**

- A. PVC: Polyvinyl chloride plastic.
- B. Flat Work: Concrete walks, concrete driveways, and asphalt paving.

**1.03 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: 5 P.S.I.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

**1.04 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

**1.05 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.02 PIPING MATERIALS**

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

### **2.03 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A888-13 including Annex A1 from accredited ANSI inspection agency or CISPI 301-12 including Annex A1 from accredited ANSI inspection agency.
  - 1. Hubless Cast-Iron Soil Pipe
    - a. Manufacturers:
      - 1) A, B & I Foundry.
      - 2) Tyler Pipe & Coupling
      - 3) Charlotte Pipe and Foundry Company
  - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings (Above Ground Use): With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO-HUSKY.
      - 2) Tyler Pipe; Soil Pipe Div.
      - 3) Mission Rubber Co.
      - 4) Clamp-All Corp.
  - 3. Heavy -Duty, Cast-Iron Couplings (Below Grade Use): ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO-HUSKY.

### **2.04 COPPER PIPE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Types L tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings.

#### **2.05 PVC PIPE AND FITTINGS:**

- A. Comply with NSF 14, "Plastic Piping Systems Components and Related Materials" for plastic piping components. Include markings with "NSF-DWV" for plastic drain, waste and vent, and "NSF=sewer" for plastic sewer piping
- B. Solid-Wall PVC Pipe: ASTM D2665, drain, waste and vent.
- C. Cellular-Core PVC Pipe: ASTM F891, Schedule 40.
- D. PCV Socket Fittings: ASTM D2665, made of ASTM D3311, drain, waste, and vent patterns and fit to Schedule 40 pipe.
- E. Adhesive Primer: ASTM F656.
- F. Solvent Cement: ASTM D2564

#### **2.06 SPECIAL PIPE FITTINGS**

- A. Shielded Nonpressure Pipe 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.
  1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Mission Rubber Co.
- B. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
  1. Manufacturers:
    - a. ANACO.
- C. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  1. Manufacturers:
    - a. SIGMA Corp.

#### **2.07 ENCASEMENT FOR UNDERGROUND METAL PIPING**

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.
- B. Form: Sheet.
- C. Color: Black.
- D. Corrosion Control: Refer to Soil Corrosivity Study and Report for further requirements.

## **PART 3 - EXECUTION**

### **3.01 EXCAVATION**

- A. Refer to Division 31 Section for excavating, trenching, and backfilling.

### **3.02 PIPING APPLICATIONS**

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Steel pipe, drainage fittings, and threaded joints.
- B. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 3. Steel pipe, drainage fittings, and threaded joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 3. Steel pipe, drainage fittings, and threaded joints.
- D. Aboveground, vent piping NPS 5 and larger shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 3. Steel pipe, drainage fittings, and threaded joints.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.
- F. Underground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.
- G. Condensate Piping: Type L hard drawn copper pipe with wrought copper solder fittings and couplings.

### **3.03 PIPING INSTALLATION**

- A. Sanitary sewer piping outside the building is specified in Division 33.

- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install seismic restraints on piping. In accordance with Mason Seismic restraints guidelines.
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- G. 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.
- H. 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 2 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.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. 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.
- J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building 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. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- N. All interior condensate piping shall be insulated with closed cell foam insulation: with FHC 25/50 composite rating.

### **3.04 JOINT CONSTRUCTION**

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. All joints of buried hubless cast iron pipe and cast iron couplings shall be field wrapped.
  - 1. Prior to wrapping, fittings and field joints shall be washed with a non-oily solvent and then cleaned with a wire brush. After cleaning, fittings and field joints shall be coated and wrapped as follows:
    - a. Coat of Koppers "Jet-Set" coal tar primer, applied uniformly to dry surfaces.
    - b. Two layers of 2" wide 35 mils thick Polyken 931 black butyl rubber molding tape with 1" lap, covered with one layer of ¾" wide 15 mils thick Polyken 930 black polyethylene pressure sensitive tape with ¼" lap.
    - c. Field wrapping shall extend 3 inches beyond joint.

### **3.05 HANGER AND SUPPORT INSTALLATION**

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - 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. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping at base and at each floor.
- E. Rod diameter may be reduced 1 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: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
- 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: 12 feet with 3/4-inch rod.
  8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.06 CONNECTIONS**

- A. Interruption of Existing Sanitary Waste System: Do not interrupt Existing Sanitary Waste System to facilities occupied by Owner or others unless permitted under the following conditions:
  1. Notify Architect, Construction Manager, and Owner no fewer than seven (7) days in advance of proposed interruption.
  2. Do not proceed with interruption without Architect's Construction Manager's and Owner's written permission.
- B. Drawings indicate general arrangement of piping, fittings, and specialties.
- C. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- D. 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.
- E. Connect condensate to equipment with pipe sizes as indicated, but in no case shall the piping be smaller than the equipment condensate pipe size.



### **3.07 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. 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 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 for not less than one hour. Close openings in piping system and fill with water to point of overflow, but not less than 5 P.S.I.; 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.

### **3.08 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.

### **3.09 VIDEO TAPED SANITARY WASTE PIPING**

- A. Video taping shall include new and existing waste piping, and limited to the path of travel of the waste from the new construction to where the street main connection occurs.
- B. All three (3) inch and larger piping shall be subjected to video taping.
- C. The video taping shall occur after all testing of sanitary waste piping has been completed, and before flat work, such as concrete walks, and asphalt, has been installed.
- D. Film: The taping shall be provided on high resolution color film that can be displayed on a common VHS recorder.
- E. Record Drawings: The Contractor shall obtain a reproducible drawing from the Architect. The drawing shall provide accurate dimensioned record of routing of the system piping with invert elevations. Irregularities encountered such as obstructions in the pipe, broken pipe or piping that were installed differently from that shown on the drawings shall be identified, dimensioned and provided with invert elevations.
  - 1. Encountered irregularities shall be reported to the plumbing Contractor for rectification. After encountered irregularities have been corrected the Architect shall have the right to request one additional visit from the contractor performing the video recording.
  - 2. The video and the drawing are deemed to be complementary.
  - 3. Before formal acceptance of the video tape and the drawing, both items shall be delivered to the On-Site Inspector for his review. The drawings will be signed by the Inspector before being delivered to the Architect.
  - 4. If in the opinion of the Architect the record drawing is not legible or the video and the drawing are not complementary the Video Taping Contractor shall employ a satisfactory draftsman to properly perform this work.

END OF SECTION

**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Floor sinks.
  - 4. Miscellaneous sanitary drainage piping specialties.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

**1.03 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.01 CLEANOUTS**

- A. Exposed Cast-Iron Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.
    - c. MIFAB, Inc.
  - 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. Cast-Iron Floor Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.

- c. MIFAB
- 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Threaded, adjustable housing.
- 5. Body or Ferrule: Cast iron.
- 6. Clamping Device: Required.
- 7. Outlet Connection: Threaded.
- 8. Closure: Brass plug with tapered threads.
- 9. Adjustable Housing Material: Cast iron with threads.
- 10. Frame and Cover Material and Finish: Polished bronze.
- 11. Frame and Cover Shape: Round.
- 12. Top Loading Classification: Light Duty.
- 13. 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. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.
    - c. MIFAB, Inc.
  - 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. Closure: Countersunk, drilled-and-threaded plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  - 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.02 FLOOR DRAINS

- A. Cast-Iron Floor Drains FD-1:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.
    - c. MIFAB, Inc.
    - d. Watts Water Technologies
  - 2. Standard: ASME A112.6.3.
  - 3. Pattern: Floor drain.
  - 4. Body Material: Gray iron.

5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Round.
12. Top Loading Classification: Light Duty.
13. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
14. Trap Material: Cast iron.
15. Trap Pattern: Standard P-trap with trap primer connection.

## **2.03 FLOOR SINKS**

### **A. Cast-Iron Floor Sink FS-1:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, basis of design indicated on drawings:
  - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - b. Zurn Plumbing Products Group; Specification Drainage Operation.
  - c. MIFAB, Inc.
2. Standard: ASME A112.6.3.
3. Pattern: Floor Sink.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Square.
12. Top Loading Classification: Light Duty.
13. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
14. Trap Material: Cast iron.
15. Trap Pattern: Standard P-trap with trap primer connection.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- 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. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. 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.
- G. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### **3.02 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment to allow service and maintenance.

### **3.03 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

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**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Miscellaneous sanitary drainage piping specialties.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

**1.03 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.01 CLEANOUTS**

- A. Exposed Cast-Iron Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.
    - c. MIFAB, Inc.
  - 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. Cast-Iron Floor Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.
    - c. MIFAB
  - 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
  - 3. Size: Same as connected branch.
  - 4. Type: Threaded, adjustable housing.
  - 5. Body or Ferrule: Cast iron.
  - 6. Clamping Device: Required.
  - 7. Outlet Connection: Threaded.
  - 8. Closure: Brass plug with tapered threads.
  - 9. Adjustable Housing Material: Cast iron with threads.
  - 10. Frame and Cover Material and Finish: Polished bronze.
  - 11. Frame and Cover Shape: Round.
  - 12. Top Loading Classification: Light Duty.
  - 13. 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. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.
    - c. MIFAB, Inc.
  - 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. Closure: Countersunk, drilled-and-threaded plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  - 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## **2.02 FLOOR DRAINS**

- A. Cast-Iron Floor Drains FD-1:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (Refer to plans for model number)
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Zurn Plumbing Products Group; Specification Drainage Operation.

- c. MIFAB, Inc.
- 2. Standard: ASME A112.6.3.
- 3. Pattern: Floor drain.
- 4. Body Material: Gray iron.
- 5. Seepage Flange: Required.
- 6. Anchor Flange: Required.
- 7. Clamping Device: Required.
- 8. Outlet: Bottom.
- 9. Top or Strainer Material: Nickel bronze.
- 10. Top of Body and Strainer Finish: Nickel bronze.
- 11. Top Shape: Round.
- 12. Top Loading Classification: Light Duty.
- 13. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
- 14. Trap Material: Cast iron.
- 15. Trap Pattern: Standard P-trap.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- 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 wall cleanouts above urinal fixtures, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall

- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. 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.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### **3.02 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### **3.03 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.
- C. Corrosion Control: Refer to Soil Corrosivity Study and Report for further requirements.

END OF SECTION

**SECTION 22 34 00**  
**FUEL-FIRED WATER HEATERS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following fuel-fired water heaters:
  - 1. Commercial, storage, gas water heaters.
  - 2. Compression tanks.
  - 3. Water heater accessories.

**1.02 DEFINITIONS**

- A. LP Gas: Liquefied-petroleum fuel gas.

**1.03 SUBMITTALS**

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: For each type of commercial water heater, signed by product manufacturer.
- D. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 23 Section " Vibration and Seismic Controls for HVAC 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.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

#### **1.04 QUALITY ASSURANCE**

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

#### **1.05 COORDINATION**

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

#### **1.06 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired 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 Period(s): From date of Substantial Completion:
    - a. Commercial, Gas Water Heaters:
      - 1) Storage Tank: Three years.
      - 2) Controls and Other Components: Three years.
    - b. Compression Tanks: One year(s).

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Commercial, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
1. Manufacturers:
    - a. Bradford White Corporation.
    - b. Lochinvar Corporation.
    - c. Smith, A. O. Water Products Company.
  2. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
    - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
    - 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. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
  3. Factory-Installed, Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    - e. Jacket: Steel with enameled finish.
    - f. Burner: For use with power-vent water heaters and for natural-gas fuel.
    - g. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
    - h. Temperature Control: Adjustable thermostat.
    - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    - j. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valve with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
  4. Special Requirements: NSF 5 construction.
  5. Power-Vent System: Exhaust fan, interlocked with burner.

6. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.
7. Capacity and Characteristics: (See schedule on drawings).

## **2.02 COMPRESSION TANKS**

- A. 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.
  1. Manufacturers:
    - a. AMTROL Inc.
    - b. Armstrong Pumps, Inc.
    - c. Smith, A. O.; Aqua-Air Div.
    - d. Watts Regulator Co.
  2. 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.
  3. Capacity and Characteristics: (See schedule on drawings).

## **2.03 WATER HEATER ACCESSORIES**

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
  1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
- E. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
  1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
- F. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.
- G. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.



- H. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
- I. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

## **2.04 SOURCE QUALITY CONTROL**

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

## **PART 3 - EXECUTION**

### **3.01 WATER HEATER INSTALLATION**

- A. Install commercial water heaters as indicated on drawings.
  - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
  - 2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing".
- B. Install 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.
- C. Install seismic restraints for commercial water heaters. Anchor to substrate.
- D. Install gas water heaters according to NFPA 54.
- E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
- F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- H. 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.
- I. Install combination temperature and pressure relief valves in water piping for 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.
- J. 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 water

heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.

- K. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages" for thermometers.
- L. Install pressure gage(s) on inlet and outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages" for pressure gages.
- M. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "Valves" for general-duty valves and to Division 22 Section "Meters and Gages" for thermometers.
- N. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- O. Fill water heaters with water.
- P. Charge compression tanks with air.

### **3.02 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.03 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. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

### **3.04 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water heaters. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

**SECTION 22 40 00**  
**PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Faucets for lavatories and sinks.
  - 2. Flushometers.
  - 3. Toilet seats.
  - 4. Protective shielding guards.
  - 5. Fixture supports.
  - 6. Water closets.
  - 7. Lavatories.
  - 8. Sinks.
  - 9. Service sinks.
- B. Related Sections include the following:
  - 1. Division 22 Section "Drinking Fountains and Water Coolers."

**1.02 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

**1.03 SUBMITTALS**

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

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. Regulatory Requirements: Comply with requirements for fixtures for people with disabilities. CBC 2019 11B & 2010 ADA standards.
- C. Regulatory Requirements
  - 1. 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.
  - 2. Effective March 1, 2017, all single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with Section 11B-216.8 and 11B703.7.2.6.3. No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of Section 11B-703. Examples of appropriate designations are "ALL GENDER RESTROOM", "RESTROOM" OR "UNISEX RESTROOM". DSA BU 17-01.
  - 3. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
  - 4. 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.
  - 5. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.
  - 6. Accessible fixture controls shall comply with CBC Section 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closet, 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 for dryers.
  - 7. Accessible lavatories and sinks shall be mounted with the front of the higher rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Section 11B-606.3 and 11B-606.7
  - 8. Water supply and drain pipes under accessible lavatories and sinks be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.

4. Vitreous-China Fixtures: ASME A112.19.2M.
  5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
  6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  4. Faucets: ASME A112.18.1.
  5. Hose-Connection Vacuum Breakers: ASSE 1011.
  6. Hose-Coupling Threads: ASME B1.20.7.
  7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  8. NSF Potable-Water Materials: NSF 61.
  9. Pipe Threads: ASME B1.20.1.
  10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  11. Supply Fittings: ASME A112.18.1.
  12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
  2. Brass and Copper Supplies: ASME A112.18.1.
  3. Manual-Operation Flushometers: ASSE 1037.
  4. Brass Waste Fittings: ASME A112.18.2.
- J. Fixture controls shall comply with CBC section; 11B-608.5 for showers, 11B-606.4 for lavatories, 11B-604.6 for toilets and 11B-605.4 for Urinals.
1. Disposers: ASSE 1008 and UL 430.
  2. Flexible Water Connectors: ASME A112.18.6.
  3. Grab Bars: ASTM F 446.
  4. Hose-Coupling Threads: ASME B1.20.7.
  5. Off-Floor Fixture Supports: ASME A112.6.1M.
  6. Pipe Threads: ASME B1.20.1.
  7. Plastic Toilet Seats: ANSI Z124.5.
  8. Supply and Drain Protective Shielding Guards: 2019 CBC & 2010 ADA Standards.

## **PART 2 - PRODUCTS**

### **2.01 SINK FAUCETS**

#### **A. Sink Faucets:**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago Faucets or a comparable product by one of the following: (Refer to plans for model number)
  - a. Delta Faucet Company
2. Description: Kitchen faucet with spray, three-hole fixture Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: Commercial, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Maximum Flow Rate: 1.5 gpm, unless otherwise indicated.
  - d. Mixing Valve: Two-lever handle.
  - e. Centers: 4 inches.
  - f. Mounting:
  - g. Handle(s):
  - h. Spout Type: Rigid, solid brass.
  - i. Spout Outlet: Aerator.
  - j. Drain: Grid offset tailpiece. Just

### **2.02 FLUSHOMETERS**

#### **A. Flushometers:**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan Regal/Royal or a comparable product by one of the following: (Refer to plans for model number)
  - a. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
  - a. Internal Design: Diaphragm operation.
  - b. Style: Exposed.
  - c. Inlet Size: NPS 1.
  - d. Trip Mechanism: Manually Activated.
  - e. Consumption: 1.28 gal./flush (water closet) and 0.125 gal./flush (urinal).
3. Tailpiece Size: NPS 1 ½ and standard

## **2.03 TOILET SEATS**

### **A. Toilet Seats:**

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings Beneke or a comparable product by one of the following: (Refer to plans for model number)
  - a. Church Seats.
4. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic.
  - b. Configuration: Open front without cover.
  - c. Size: Elongated.
  - d. Hinge Type: SS, self-sustaining.
  - e. Class: Standard commercial.
  - f. Color: White.

## **2.04 PROTECTIVE SHIELDING GUARDS**

### **A. Protective Shielding Pipe Covers:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Plumberex Specialty Products Inc.
  - b. TRUEBRO, Inc.
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 (ACC) requirements.

## **2.05 FIXTURE SUPPORTS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Smith, Jay R. Mfg. Co.
  2. MIFAB Manufacturing Inc.
  3. Zurn Plumbing Products Group; Specification Drainage Operation.



- C. Urinal Supports:
  - 1. Description: Type II, urinal carrier with hanger and bearing plates for wall-mounting, urinal-type fixture. Include steel uprights with feet.
  - 2. Accessible-Fixture Support: Include rectangular steel uprights.
- D. Lavatory Supports:
  - 1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
  - 2. Accessible-Fixture Support: Include rectangular steel uprights.

## **2.06 WATER CLOSETS**

- A. Water Closets, WC-1 and WC-2 (ACC):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standards Brand vitreous china as indicate on the drawings or a comparable product by one of the following: (Refer to plans for model number).
    - a. Kohler Company.
    - b. Zurn Industries.
    - c. Sloan Valve Company.
    - d. Or approved equivalent.
  - 2. Description: Accessible, floor-mounting, floor-outlet, designed for pressure-assisted siphon jet action .
  - 3. Style: pressure-assisted siphon jet action tank type.
    - a. Bowl Type: Elongated with pressure-assisted siphon-jet design. Include bolt caps matching fixture.
    - b. Height: Standard and Accessible (See Drawings).
    - c. Design Consumption: 1.28 gal./flush.
    - d. Color: White.

## **2.07 LAVATORIES**

- A. Lavatories, L-1 and L-2 (ACC):
  - 1. Basis-of-Design Product: Subject to compliance with requirements provide American Standards Brand vitreous china as indicated on the drawings or a comparable product by one of the following: (Refer to plans for model number).
    - a. Kohler Company
    - b. Zurn Industries.
    - c. Sloan Valve Company.
    - d. Or approved equivalent.

2. Description: Accessible Wall Type Lavatory: drilled for concealed arm assembly; furnished with wall mounted concealed lavatory arm assembly; strainer with 1¼" offset tailpiece, self closing faucet with vandal proof ½ gpm flow control, Chicago no. 1006 ½" loose key angle stop with ½" I.P.S. female inlet x 3/8" compression male outlet and brass wall escutcheon; Fluidmaster No-Burst B1F12 I.A.P.M.O. listed 3/8" x 12" braided stainless steel flexible risers with non-toxic polymer liner, 3/8" compression female inlet, ½" I.P.S. female outlet and hexagon non-ferrous nuts; 1¼" x 1½" cast brass L.A. "P" trap. Assembly shall comply with C.P.C. requirements for accessible fixtures.

## **2.08 SINKS**

### **A. Sink, S-1 (ACC) :**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Just Manufacturing Company or a comparable product by one of the following: (Refer to plans for model number).
  - a. Elkay Manufacturing Co.
2. Description: 18 gauge, Type 304 stainless steel single compartment with stainless steel strainer with 1½" tailpieces; faucet vandal proof 1.5 gpm laminar flow control, Chicago angle stop fitting no. 1006 ABCP ½" inlet and outlet to slip 3/8" O.D. tubing and brass wall escutcheons, continuous brass drain and 1½" cast brass L.A. "P" trap. Assembly shall comply with C.P.C requirements for accessible fixtures.

## **2.09 SERVICE SINKS**

### **A. Service Sinks, SS-1:**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Co. as indicated on the drawings or a comparable product. (Refer to plans for model number)
2. Description: Trap-standard- and floor-mounting, enameled, cast-iron fixture with roll-rim with plain back and rim guard on front and sides.
  - a. Size: 28 by 28 inches.
  - b. Color: White.
  - c. Drain: Grid with NPS 3 outlet.
  - d. Trap Standard: NPS 3 enameled, cast iron with cleanout and floor flange.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.

2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
  - D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
  - E. Install wall-mounting fixtures with tubular waste piping attached to supports.
  - F. Install fixtures level and plumb according to roughing-in drawings.
  - G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
  - I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
  - J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
  - K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
  - L. Install toilet seats on water closets.
  - M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
  - N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
  - O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
  - P. Install traps on fixture outlets.
    1. Exception: Omit trap on fixtures with integral traps.
    2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
  - Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
  - R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### **3.02 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.03 FIELD QUALITY CONTROL**

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

### **3.04 PROTECTION**

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

**SECTION 22 47 00**  
**DRINKING FOUNTAINS AND WATER COOLERS**

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Wall-mounting drinking fountains/bottle filler.

**1.02 SUBMITTALS**

- A. Regulatory Requirements: Comply with requirements for fixtures for people with disabilities. 2022 CBC & 2010 ADA standards.
- B. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

**PART 2 - PRODUCTS**

**2.01 DRINKING FOUNTAINS**

- A. Drinking Fountain and Bottle Filling Station, DF-1 (ACC):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay Manufacturing Company or a comparable product by one of the following: (Refer to plans for model number).
    - a. Haws Corporation
    - b. Murdock Manufacturing
  - 2. Description: Wall-mounted drinking fountain.
    - a. Material: Barrier-free drinking fountain shall include dual type 304 stainless steel satin finish basins.
    - b. Receptor Shape: None.
    - c. Back Panel: Stainless-steel wall plate.
    - d. Bottle Filling: Hands-free, sensor operated.
    - e. Bubblers: None.
    - f. Bubbler Control: None.
    - g. Supply: NPS 3/8 with ball, gate, or globe valve.
    - h. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.19.3.

**PART 3 – EXECUTION**

**3.01 APPLICATIONS**

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Set freestanding and pedestal drinking fountains on floor.

- C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

### **3.01 INSTALLATION**

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to 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 Division 22 Section "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 pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### **3.03 CONNECTIONS**

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.04 FIELD QUALITY CONTROL**

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
  - 1. Remove and replace malfunctioning units and retest as specified above.
  - 2. Report test results in writing.

### **3.05 ADJUSTING**

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

END OF SECTION

**SECTION 23 05 13**  
**COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.01 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.

**1.02 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.

**PART 2 - PRODUCTS**

**2.01 GENERAL MOTOR REQUIREMENTS**

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

**2.02 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg 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.

**2.03 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. Rotor: Random-wound, squirrel cage.

- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### **2.04 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.

#### **2.05 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

**SECTION 23 05 29**  
**HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Fastener systems.
  - 5. Equipment supports.
- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

**1.02 DEFINITIONS**

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.03 PERFORMANCE REQUIREMENTS**

- A. ASCE 7-10 Chapter 13 & 2022 C.B.C. Chapter 16A.
- B. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

**1.04 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Powder-actuated fastener systems.
- B. Welding certificates.

**1.05 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.02 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. AAA Technology & Specialties Co., Inc.
  - 2. Bergen-Power Pipe Supports.
  - 3. B-Line Systems, Inc.; a division of Cooper Industries.
  - 4. Globe Pipe Hanger Products, Inc.
  - 5. Grinnell Corp.
  - 6. GS Metals Corp.
  - 7. Piping Technology & Products, Inc.
  - 8. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### **2.03 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### **2.04 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Power-Strut Div.; Tyco International, Ltd.
  - 3. Thomas & Betts Corporation.
  - 4. Tolco Inc.

- 5. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Pregalvanized or hot dipped for outdoors. Manufacturers standard finish indoors.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## **2.05 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Hilti, Inc.
    - c. ITW Ramset/Red Head.
    - d. MKT Fastening, LLC.
    - e. Powers Fasteners.

## **2.06 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## **2.07 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, 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**

## **3.01 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.
- F. 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 120 to 450 deg F pipes, NPS 4 to NPS 16, 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 24, requiring clamp flexibility and up to 4 inches of insulation.
  4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  6. 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.
  7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  8. 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.
- G. 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 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. 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.
- I. 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. 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.
- 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. 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.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  - 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

### **3.02 HANGER AND SUPPORT INSTALLATION**

- A. Steel 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 building structure.
- B. 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 above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
  1. Install powder-actuated fasteners 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 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 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 so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- L. Insulated Piping: Comply with the following:
  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 according to ASME B31.1 for power piping and 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.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  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 inserts.
- 6. Insert Material: Length at least as long as protective shield.

### **3.03 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 smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### **3.04 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for 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 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 contours of welded surfaces match adjacent contours.

### **3.05 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### **3.06 PAINTING**

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

END OF SECTION





## **SECTION 23 05 48**

### **VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Elastomeric Isolation Pads.
  - 2. Restrained spring isolators.
  - 3. Restrained vibration isolation roof-curb.
  - 4. Seismic- Restraint Devices.

##### **1.02 DEFINITIONS**

- A. Effective peak velocity related acceleration coefficient.
- B. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "OPM" number to each seismic restraint it tests. The number describes a specific device applied as tested.

##### **1.03 PERFORMANCE REQUIREMENTS**

- A. According to seismic code of Governing Jurisdiction.
- B. Component Seismic Coefficient: Refer to equipment schedule for value for each piece of equipment.
- C. Performance Criteria Factor: Refer to equipment schedule for value for each piece of equipment.
- D. Attachment Amplification Factor: Refer to equipment schedule for value for each piece of equipment.

##### **1.04 INFORMATIONAL SUBMITTALS**

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.
- C. Welding certificates.
- D. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
    - 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.

#### **1.05 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For restraint-air spring mounts to include in operation and maintenance manuals.

#### **1.06 QUALITY ASSURANCE**

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "OPM" number, from OSHPD or 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 not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

#### **1.07 COORDINATION**

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### **2.02 ELASTOMERIC ISOLATION PADS**

- A. Elastomeric Isolation Pads:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
  - 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.
- B. Surface Pattern: Ribbed pattern.

### **2.03 VIBRATION ISOLATORS**

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Mason Industries, Inc.
  - 2. M. W. Sausse'.
- C. Restrained Spring Isolators (RSI): Freestanding, steel, open-spring isolators with seismic restraint.
  - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  - 2. Outside 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 the rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.04 VIBRATION ISOLATION SEISMIC CURB

- A. Manufacturers:
  - 1. Micro Metl
  - 2. Mason Industries, Inc.
  - 3. M. W. Sausse'.
- B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph wind impinging laterally against side of equipment.
- C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.
- D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
  - 1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
    - a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    - d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
    - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 2. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
    - a. Material: Bridge-bearing neoprene, complying with AASHTO M 251.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

## **2.05 SEISMIC-RESTRAINT DEVICES**

- A. Manufacturers:
  - 1. Mason Industries, Inc.
  - 2. TOLCO Incorporated.
  - 3. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
  - 4. M. W. Sausse'.
  - 5. B- Line Systems.
- B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.
- C. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  - 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.
- D. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.
- E. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

## **2.06 FACTORY FINISHES**

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  - 1. Powder coating on springs and housings.
  - 2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
  - 3. Baked enamel for metal components on isolators for interior use.
  - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

- 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.

### **3.02 INSTALLATION**

- A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 07.
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- F. Install resilient bolt isolation washers on equipment anchor bolts.

### **3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION**

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

### **3.04 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  - 1. Isolator seismic-restraint clearance.
  - 2. Isolator deflection.
  - 3. Snubber minimum clearances.

### **3.05 ADJUSTING**

- A. Adjust isolators after piping systems have been filled and equipment 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.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust active height of spring isolators.
- E. Adjust snubbers according to manufacturer's written recommendations.
- F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

- G. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

### **3.06 CLEANING**

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

### **3.07 VIBRATION ISOLATOR AND SEISMIC-RESTRAINT SCHEDULE**

- A. Supported Equipment:
  - 1. Package Rooftop AC units:
    - a. Isolation Type: Structurally Calculated Isolation Roof Support Curb
    - b. Deflection: 2"

END OF SECTION

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**SECTION 23 05 53**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.

**1.02 SUBMITTAL**

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

**PART 2 - PRODUCTS**

**2.01 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: Black.
  - 3. Background Color: White.
  - 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 rivets or self-tapping screws.
  - 8. 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.

## **2.02 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 or Orange.
- 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.

## **2.03 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 partially cover 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 inches high.

## **2.04 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. Letter Color: White.
- C. Background Color: Blue.
- 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. 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.

## **PART 3 - EXECUTION**

### **3.01 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.

### **3.02 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.03 PIPE LABEL INSTALLATION**

- A. 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.
- B. Pipe Label Color Schedule:
  - 1. Refrigerant Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.

### **3.04 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.

END OF SECTION

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Balance Air Systems:
    - a. Constant-volume air systems.
  - 2. Kitchen hood airflow balancing.
  - 3. Verifying that automatic control devices are functioning properly.
  - 4. Reporting results of activities and procedures specified in this Section.

**1.02 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 45 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.

**1.03 QUALITY ASSURANCE**

- A. TAB Firm Qualifications: Engage one of the following TAB firms certified by AABC.
  - 1. American Air Balance Company.
  - 2. Winaire.
  - 3. Los Angeles Air Balance Co., Inc.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

#### **1.04 COORDINATION**

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

#### **1.05 WARRANTY**

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

### **PART 2 - PRODUCTS (Not Applicable)**

### **PART 3 - EXECUTION**

#### **3.01 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.
  1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. 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.
- D. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC

Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

- E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- F. Examine system and equipment test reports.
- G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- I. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at indicated values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to indicated values.
- N. 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.



### **3.02 PREPARATION**

- A. Complete system readiness checks and prepare system readiness 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. Balance, smoke, and fire dampers are open.
  - 5. Isolating and balancing valves are open and control valves are operational.
  - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

### **3.03 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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### **3.04 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. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.

- J. Check for proper sealing of air-handling unit components.
- K. Check for proper sealing of air duct system.

### **3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS**

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable 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 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.
  - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
  - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
  - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
  - 6. 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 modes 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 static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    - 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. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

### **3.06 PROCEDURES FOR COMMERCIAL KITCHEN HOODS**

- A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.
  1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.
- B. After balancing is complete, do the following:
  1. Measure and record the static pressure at the hood exhaust-duct connection.
  2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.
  3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.

### **3.07 PROCEDURES FOR MOTORS**

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  1. Manufacturer, model, and serial numbers.
  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.

### **3.08 PROCEDURES FOR CONDENSING UNITS**

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### **3.09 PROCEDURES FOR HEAT-TRANSFER COILS**

- A. Refrigerant Coils: Measure the following data for each coil:
  1. Dry-bulb temperature of entering and leaving air.
  2. Wet-bulb temperature of entering and leaving air.

3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

### **3.10 PROCEDURES FOR TEMPERATURE MEASUREMENTS**

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

### **3.11 TEMPERATURE-CONTROL VERIFICATION**

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

### **3.12 TOLERANCES**

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent of design CFM.
  2. Air Outlets and Inlets: Plus or minus 10 percent of design CFM.

### **3.13 FINAL REPORT**

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.
- C. 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, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  1. Title page.
  2. Name and address of TAB firm.
  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 firm 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. Notes to explain why certain final data in the body of reports varies from indicated values.
  14. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, 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. Settings for supply-air, static-pressure controller.
    - g. Other system operating conditions that affect performance.

- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. A copy of the original mechanical design drawings is NOT acceptable. Present each system with single-line diagram and include the following:
  - 1. Quantities of outside, supply, return, and exhaust airflows.
  - 2. Duct, outlet, and inlet sizes.
  - 3. Balancing stations.
  - 4. Position of balancing devices.
  - 5. Floor plan with room names.

### **3.14 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 Owner.
- 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

### **3.15 ADDITIONAL TESTS**

- A. Within 90 days of completing TAB, perform additional testing and balancing 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 testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

## **SECTION 23 07 00**

### **DUCT INSULATION**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:
  - 1. Insulation Materials:
    - a. Mineral-Fiber blanket.
  - 2. Adhesives.
  - 3. Tapes.
  - 4. Securements.
  - 5. Corner angles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Metal Ducts" for duct liners.

##### **1.02 DEFINITIONS**

- A. FSK: Foil, scrim, kraft paper.
- B. FSP: Foil, scrim, polyethylene.
- C. SSL: Self-sealing lap.

##### **1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 3. Removable insulation at piping specialties, equipment connections, and access panels.
  - 4. Application of field-applied jackets.
  - 5. Application at linkages of control devices.
  - 6. Field application for each equipment type.
- C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.
- D. 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.



#### **1.04 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. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting 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.

#### **1.05 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.

#### **1.06 COORDINATION**

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### **1.07 SCHEDULING**

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. 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.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## **2.02 INSULATION MATERIALS**

- A. Refer to Part 3 schedule articles for requirements about 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 Part 2 "Factory-Applied Jackets" Article.
  1. Products:
    - a. Johns Manville; Microlite.
    - b. Knauf Insulation; Duct Wrap.
    - c. Owens Corning; All-Service Duct Wrap.
    - d. Certainteed Corp.; Soft Touch Duct Wrap.

## **2.03 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:
    - a. Aeroflex USA Inc.; Aero seal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.

## 2.04 TAPES

- A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
  - 1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    - d. Venture Tape; 3520 CW.
  - 2. Width: 2 inches.
  - 3. Thickness: 3.7 mils.
  - 4. Adhesion: 100 ounces force/inch in width.
  - 5. Elongation: 5 percent.
  - 6. Tensile Strength: 34 lbf/inch in width.

## 2.05 SECUREMENTS

- A. Insulation Pins and Hangers:
  - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
    - a. Products:
      - 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, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
    - a. Products:
      - 1) AGM Industries, Inc.; CWP-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:
      - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      - 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. 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. Available Products:
    - 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.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, galvanized steel.
  - 1. Manufacturers:
    - a. ACS Industries, Inc.
    - b. C & F Wire.
    - c. Childers Products.
    - d. PABCO Metals Corporation.
    - e. RPR Products, Inc.

## **2.06 CORNER ANGLES**

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. 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**

### **3.01 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment 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.

### **3.02 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### **3.03 COMMON INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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 as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and 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. Manholes.
  5. Handholes.
  6. Cleanouts.

### **3.04 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. 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.
  1. Firestopping and fire-resistive joint sealers are specified in 07 84 00 "Firestopping."

### **3.05 MINERAL-FIBER INSULATION INSTALLATION**

- 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 (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) 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 (10 deg C) at 18-foot (5.5-m) 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 2 times the insulation thickness but not less than 3 inches (75 mm).
- 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.

### **3.06 FINISHES**

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
  - 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. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

### **3.07 DUCT INSULATION SCHEDULE, GENERAL**

- A. Plenums and Ducts Requiring Insulation:
  - 1. Supply and return air ducts.
- 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.
  - 8. Exposed-to-view ducts within conditioned space they serve.
  - 9. Exhaust ducts.

### **3.08 INDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. Exposed supply, return, outside air and relief ducts located in mechanical rooms:



1. 2 inch thick duct liner-see Metal Ducts Section.

B. Concealed supply and return air ducts:

1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density. Minimum installed R-Value of 8.0.

**3.09 ABOVEGROUND, OUTDOOR SUPPLY AND RETURN DUCT AND PLENUM INSULATION SCHEDULE**

A. 2" thick duct liner- see Metal Ducts section.

END OF SECTION

## **SECTION 23 31 13**

### **METAL DUCTS**

#### **PART 1 - GENERAL**

##### **1.01 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. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

##### **1.02 PERFORMANCE REQUIREMENTS**

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. 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.
  - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

##### **1.03 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 and bottom 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.

Note: Use of engineer's approved drawings with Contractor's marks, notes, dimensions, elevations, etc. will not be accepted as complying with Shop Drawings requirement. Contractor shall provide his own drawing(s) as required.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

D. 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.
- E. Welding certificates.
  - F. Field quality-control reports.

#### **1.04 QUALITY ASSURANCE**

- A. 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 D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

### **PART 2 - PRODUCTS**

#### **2.01 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."

## **2.02 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.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) 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."

## **2.03 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. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article
- 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.

## 2.04 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.
      - 1) Type 300, Flexible: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 2. Solvent-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. Flexible Elastomeric: Fiber-free, closed cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 1. Products:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
    - d. Imcoa
- C. 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.
- D. 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.

## **2.05 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. Water-Based Joint and Seam Sealant:
  1. Application Method: Brush on.
  2. Solids Content: Minimum 66 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 77 g/L.
  7. Maximum Static-Pressure Class: 15-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.
- C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

## **2.06 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.

## 2.07 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 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**

#### **3.01 DUCT INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts 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 Division 23 Section "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", Level C Advanced Level.

#### **3.02 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.

### **3.03 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT**

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts or as indicated on Drawings.
- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

### **3.04 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. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 3. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 4. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 5. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 7. Conditioned Space, Return-Air Ducts: Seal Class B.

### **3.05 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, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
- 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.

### **3.06 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 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.

### **3.07 CONNECTIONS**

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### **3.08 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 Division 09 painting Sections.

### **3.09 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Leakage Tests:
  - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  - 2. Test the following systems:
    - a. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100percent of total installed duct area for each designated pressure class.
    - b. Outdoor Air Ducts: Test representative duct sections totaling no less than 50percent of total installed duct area for each designated pressure class
  - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 4. Test for leaks before applying external insulation.
  - 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  - 6. Give seven days' advance notice for testing.
- C. 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.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Ductwork shall be keep covered at all time during construction. Follow SMACNA best practices for keeping ductwork clean during construction.
- F. Prepare test and inspection reports.

### 3.10 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

### 3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Ducts:
  - 1. Ducts Connected to Air Conditioning Units:
    - a. Pressure Class: Positive 2-inch wg.
    - b. SMACNA Leakage Class for Rectangular: 12.
    - c. SMACNA Leakage Class for Round and Flat Oval: 12
  - 2. Ducts Connected to Equipment Not Listed Above:
    - a. Pressure Class: Positive 2-inch wg.
    - b. SMACNA Leakage Class for Rectangular: 12.
    - c. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
  - 1. Ducts Connected to Air Conditioning Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. SMACNA Leakage Class for Rectangular: 12.
    - c. SMACNA Leakage Class for Round and Flat Oval: 12.
  - 2. Ducts Connected to Equipment Not Listed Above:
    - a. Pressure Class: Positive or negative 2-inch wg .
    - b. SMACNA Leakage Class for Rectangular: 12.
    - c. SMACNA Leakage Class for Round and Flat Oval: 12.
- D. Exhaust Ducts:
  - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
  - 2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
    - a. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
    - b. 16 gage welded seams and joints.
    - c. Pressure Class: Positive or negative 4-inch wg.
    - d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
    - e. SMACNA Leakage Class: 3

3. Ducts Connected to Dishwasher Hoods:
  - a. Type 304, stainless-steel sheet.
  - b. Exposed to View: No. 4 finish.
  - c. Concealed: No. 2D finish.
  - d. Welded seams and flanged joints with watertight EPDM gaskets.
  - e. Pressure Class: Positive or negative 2-inch wg.
  - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
  - g. SMACNA Leakage Class: 3
4. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
  - a. Type 316, stainless-steel sheet.
    - 1) Exposed to View: No. 4 finish.
    - 2) Concealed: No. 2B finish.
  - b. Pressure Class: Positive or negative 3-inch wg.
  - c. Minimum SMACNA Seal Class: A.
  - d. SMACNA Leakage Class: 3
5. Ducts Connected to Equipment Not Listed Above:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round and Flat Oval: 12
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
  1. Duct Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- F. Intermediate Reinforcement:
  1. Galvanized-Steel Ducts: Galvanized steel.
  2. Stainless-Steel Ducts:
    - a. Exposed to Airstream: Match duct material.
    - b. Not Exposed to Airstream: Galvanized.
  3. Aluminum Ducts: Aluminum.
- G. Liner:
  1. Supply Air Ducts: Fibrous glass, Type 300, 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



**SECTION 23 33 00**  
**AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Combination fire and smoke dampers.
  - 3. Turning vanes.
  - 4. Remote damper operators.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.
  - 8. Duct accessory hardware.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. 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. Control-damper installations.
    - d. Combination fire- and smoke-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

**1.03 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.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## **1.05 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.

## **PART 2 - PRODUCTS**

### **2.01 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.

### **2.02 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.

### **2.03 MANUAL VOLUME DAMPERS**

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Durodyne.
    - b. Nailor Industries Inc.
    - c. Pottorff.
    - d. Ruskin Company.
    - e. Windgate
  - 2. Standard leakage rating, with linkage outside airstream.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.

- d. Z-inch raised stand off for externally wrapped insulated 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: Galvanized steel.
- 7. Bearings:
  - a. Oil-impregnated bronze.
  - 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.

## **2.04 COMBINATION FIRE AND SMOKE 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. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with interlocking, gusseted corners and mounting flange.
- F. Heat-Responsive Device: Resettable, 165 deg F rated, fire-closure device.
- G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- H. Smoke Detector: Integral, factory wired for single-point connection.
- I. Blades: Roll-formed, horizontal, interlocking, 0.063-inch- thick, galvanized sheet steel.
- J. Leakage: Class II.
- K. Rated pressure and velocity to exceed design airflow conditions.
- L. Mounting Sleeve: Factory-installed, 0.039-inch- thick, galvanized sheet steel; length to suit wall or floor application.
- M. Master control panel for use in dynamic smoke-management systems.
- N. Damper Motors: two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

1. 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.
  2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections as specified.
  3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
  6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  7. Electrical Connection: 115 V, single phase, 60 Hz.
- P. Accessories:
1. Auxiliary switches for position indication.
  2. Test and reset switches, remote mounted.

## 2.05 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. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- 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: Single wall.
- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.06 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Metropolitan Air Technology ("M.A.T.")
  - 2. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Copper.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Recessed.
- F. Wall-Box Cover-Plate Material: Steel.

## 2.07 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Nailor Industries Inc.
  - 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: Two hinges and two sash locks.
    - c. Access Doors up to 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: 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 at 3.0- to 8.0-inch wg.
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.

## **2.08 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 0.0528-inch 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.

## **2.09 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.

## **2.10 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.
  - 4. Casco.
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
  - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 175 deg F.
  - 4. Insulation R-Value: 8.0.

## **2.11 DUCT ACCESSORY HARDWARE**

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

## **PART 3 - EXECUTION**

### **3.01 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 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.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire and smoke dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
  2. 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.
  3. At each change in direction and at maximum 50-foot spacing.
  4. Upstream and downstream from turning vanes.
  5. Control devices requiring inspection.
  6. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. 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.
- J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Connect terminal units to supply ducts directly with a minimum of three duct diameters and a maximum of 8-foot lengths of flexible duct. Do not use flexible ducts to change directions.
- M. Connect diffusers to ducts directly with maximum 7-foot length of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Install duct test holes where required for testing and balancing purposes.

### **3.02 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 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

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## **SECTION 23 34 23**

### **HVAC POWER VENTILATORS**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Centrifugal roof ventilators.
  - 2. Ceiling exhaust fans.
  - 3. In-line centrifugal fans.

##### **1.02 PERFORMANCE REQUIREMENTS**

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

##### **1.03 INFORMATIONAL SUBMITTALS**

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and 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: 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.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Reflected ceiling 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. 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.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### **1.06 COORDINATION**

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### **PART 2 - PRODUCTS**

#### **2.01 CENTRIFUGAL ROOF VENTILATORS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  1. Greenheck.
  2. Loren Cook Company.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

- C. 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.
  - 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
  - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
  - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
  - 4. Fan and motor isolated from exhaust airstream.
- F. Accessories:
  - 1. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
  - 2. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
  - 3. Grease Removal: Provide grease exhaust removal accessories as specified on plans.
- G. 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: Self-flashing without a cant strip, with mounting flange.
  - 2. Overall Height: 12 inches.
  - 3. Pitch Mounting: Manufacture curb for roof slope so that equipment is level.
  - 4. Metal Liner: Galvanized steel.
- H. Capacities and Characteristics: As scheduled on drawings.

## **2.02 CEILING EXHAUST FANS**

- A. Manufacturers:
  - 1. Greenheck.
  - 2. Loren Cook Company.
- B. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with 1/2 inch (13 mm) acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- C. Grille: Molded white plastic or aluminum with baked white enamel finish.
- D. Roof Curb: 8 inch high self flashing of galvanized steel with continuously welded seams, built in cant strips one inch (25 mm) insulation and curb bottom, and factory installed nailer strip. Curb shall be pitched to match roof slope for a level mounting surface.
- E. Roof Cap: All aluminum construction, anti-backdraft flange, and bird screen.

## **2.03 IN-LINE CENTRIFUGAL FANS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Greenheck.
  - 2. Loren Cook Company.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- E. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
  - 3. Companion Flanges: For inlet and outlet duct connections.
  - 4. Fan Guards: ½-by 1-inch (13-mm) mesh of galvanized steel in removable frame.  
Provide guard for inlet or outlet for units not connected to ductwork.
  - 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
- F. Capacities and Characteristics
  - 1. Type: Spring hangers.
  - 2. Static Deflection: 1 inch.

## **2.04 MOTORS**

- A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed.

## **2.05 SOURCE QUALITY CONTROL**

- A. Sound-Power Level Ratings: Comply with 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. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

# **PART 3 - EXECUTION**

## **3.01 INSTALLATION**

- A. Install power ventilators level and plumb.

- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

### **3.02 CONNECTIONS**

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

### **3.03 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 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.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### **3.04 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.

- C. Refer to Division 23 Section "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

**SECTION 23 37 13**  
**DIFFUSERS, REGISTERS, AND GRILLES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

**1.02 SUBMITTALS**

- A. Product Data: For each 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.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. 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.
  - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

**2.02 GRILLES AND REGISTERS**

- A. Fixed Bar Grille: RG-1, EG-1, TG-1, SWR-1
  - 1. Manufacturers:
    - a. Price Industries.
    - b. Krueger.
    - c. Titus.



2. Material: Steel.
  3. Finish: Powder coat white enamel.
  4. Mounting: Lay in for T-bar grid ceiling, with filler material if required. Concealed screw for hard ceiling and wall.
  5. Blade Arrangement:  $\frac{3}{4}$ " spacing, 35° deflection, parallel to the long dimension.
- B. Adjustable Face Grille: SWS-1
1. Manufacturers:
    - a. Price Industries.
    - b. Krueger.
    - c. Titus.
  2. Material: Steel.
  3. Finish: Powder coat finish. Verify color with architect. Primer finish ready for field paint if connected to exposed ductwork.
  4. Mounting: Concealed screw.
  5. Blade Arrangement: Double deflection, adjustable vertical face  $\frac{3}{4}$ " spacing and adjustable horizontal rear  $\frac{3}{4}$ " spacing.

## **2.03 CEILING DIFFUSER OUTLETS**

- A. Square Ceiling Diffusers: CD-1:
1. Products: Square Cone Diffuser
  2. Manufacturers:
    - a. Price Industries.
    - b. Krueger.
    - c. Titus.
  3. Material: Steel.
  4. Finish: Powder coat white enamel.
  5. Mounting: Lay-in for T-bar grid ceiling, Frame Type 1 surface mounted full face for hard ceiling.
- B. Adjustable Face Diffusers: CD-2
1. Products: Double Deflection Diffuser.
  2. Manufacturers:
    - a. Price Industries.
    - b. Krueger.
    - c. Titus.
  3. Material: Steel.
  4. Finish: Powder coat finish, white enamel.

5. Mounting: Concealed screw.
  6. Blade Arrangement: Double defection, adjustable vertical face  $\frac{3}{4}$ " spacing and adjustable horizontal rear  $\frac{3}{4}$ " spacing.
- C. Linear Slot Diffusers LS-1:
1. Manufacturers:
    - a. Price Industries.
    - b. Krueger.
    - c. Titus.
  2. Devices shall be specifically designed for variable-air-volume flows.
  3. Material – Shell: Aluminum, insulated.
  4. Material – Pattern Controller and Tees: Aluminum.
  5. Finish – Face and Shell: Baked enamel, black.
  6. Finish – Pattern Controller: Baked, enamel, black.
  7. Finish – Tees: Baked enamel, white.
  8. Slot Width: 1 inch.
  9. Number of Slots: Two.
  10. Length: As indicated on plans.
  11. Accessories: Remote operated damper.
  12. Frame: Concealed (Discrete").

## **2.04 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**

### **3.01 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.

### **3.02 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 practicable. 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, and fire dampers.

### **3.03 ADJUSTING**

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

**SECTION 23 41 00**  
**PARTICULATE AIR FILTRATION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

**1.02 SUBMITTALS**

- A. Product Data: Include dimensions; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each unit indicated.
- B. Operation and maintenance data.

**1.03 QUALITY ASSURANCE**

- A. Comply with ARI 850.
- B. Comply with ASHRAE 52.1 and ASHRAE 52.2 for method of testing and rating air-filter units.
- C. Comply with NFPA 90A and NFPA 90B.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

**1.05 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with prospective covering for storage and identified with labels describing contents.
  - 1. Provide one complete set(s) of filters for each filter bank (e.g. each A/C unit).

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Airguard Industries, Inc.
  - 2. Farr Co.
  - 3. Flanders Filters, Inc.
- B. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with holding frames.
  - 1. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
  - 2. Frame: Cardboard frame with perforated metal retainer.

3. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.
  4. Efficiency: MERV 8.
- C. Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with holding frames.
1. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
  2. Media and Media-Grid Frame: Nonflammable cardboard.
  3. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, and suitable for bolting together into built-up filter banks.
  4. Efficiency: MERV 8.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- B. Install filters in position to prevent passage of unfiltered air.
- C. Coordinate filter installations with duct and air-handling unit installations.

END OF SECTION

**SECTION 238127**  
**VARIABLE REFRIGERANT FLOW (VRF) SPLIT-SYSTEM HEAT PUMP,**  
**BRANCH SELECTOR AND FAN COIL UNITS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Per the equipment schedule, the variable capacity, heat pump air conditioning system basis of design is Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system(s).
- B. Acceptable alternative manufacturers, assuming compliance with these equipment specifications, are Daikin, Panasonic, and Hitachi. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

**1.02 QUALITY ASSURANCE**

- A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.
- E. System start-up supervision shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.

**1.03 DELIVERY AND STORAGE HANDLING**

- A. Unit shall be stored and handled according to the manufacturer's recommendation.

**PART 2 – PRODUCTS**

**2.01 WARRANTY**

- A. The CITY MULTI units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.

- B. Installing contractor shall meet manufacturer requirements to obtain extended manufacturer's limited parts and compressor warranty for a period of ten (10) years to the original owner from date of installation. This warranty shall not include labor.
- C. Manufacturer shall have a minimum of fifteen (15) years continuous experience providing VRF systems in the U.S. market.
- D. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required.
- E. Registering and sign-in requirements which may delay emergency service reference are not allowed.
- F. The CITY MULTI VRF system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

### **PART 3 – OUTDOOR UNITS**

#### **3.01 GENERAL**

- A. The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
- B. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.
- C. Outdoor unit shall have a sound rating no higher than 65 dB(A) individually or 70 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 54.5 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
- D. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.
- E. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.
- F. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.
- G. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

- H. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.
- I. The outdoor unit shall be capable of guaranteed operation in heating mode down to -18°F ambient temperatures and cooling mode up to 126°F without additional restrictions on line length & vertical separation beyond those published in respective product catalogs. Models with capacity data for required temperature range published as "for reference only" are not considered capable of guaranteed operation and are not acceptable. If an alternate manufacturer is selected, any additional material, cost, and labor to meet ambient operating range and performance shall be incurred by the contractor.
- J. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.
- K. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.
- L. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature, systems that keep fan running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.
- M. The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer supplied low ambient kit.
  - 1. Low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
  - 2. Low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
  - 3. Low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
- N. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

### **3.02 UNIT CABINETS**

- A. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.
- B. Outdoor unit components shall be coated with the Seacoast Protection Coating (Brine Spray – BS coating) to protect components from premature corrosion due to a seacoast environment. Coating shall be applied to components before original outdoor unit assembly to



ensure manufacturer quality standards are not compromised and shall meet the following minimum requirements:

1.  $\geq 85\mu\text{m}$  thermoset polyester-resin powder coating on External Front Panel
  2.  $\geq 70\mu\text{m}$  thermoset polyester-resin powder coating on External Panel Base, Pillar, Compressor Cover, Fan Motor Support, Electrical Box..
  3.  $\geq 1\mu\text{m}$  cellulose and polyurethane-resin coating on heat exchanger fins.
  4.  $\geq 10\mu\text{m}$  polyurethane coating on printed circuit boards
- C. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.
- D. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.

### **3.03 FAN**

- A. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG external static pressure, but capable of normal operation with a maximum of 0.32 in. WG external static pressure via dipswitch.
- B. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
- C. All fans shall be provided with a raised guard to prevent contact with moving parts.

### **3.04 REFRIGERANT AND REFRIGERANT PIPING**

- A. R410A refrigerant shall be required for systems.
- B. Polyolester (POE) oil - widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
- C. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.
- D. All refrigerant piping must be insulated with  $\frac{1}{2}$ " closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.
- E. Refrigerant line sizing shall be in accordance with manufacturer specifications.

### **3.05 COIL**

- A. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil.
- B. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturer's in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric

basis of design. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.

- C. The outdoor heat exchanger shall be of zinc coated aluminum construction with turbulating flat tube construction. The coil fins shall have a factory applied corrosion resistant finish. Uncoated aluminum coils/fins are not allowed.
- D. The coil shall be protected with an integral metal guard.
- E. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
- F. Unit shall have prewired plugs for optional panel heaters in order to prevent any residual ice buildup from defrost. Panel heaters are recommended for operating environments where the ambient temperature is expected to stay below -1F for 72 hours.
- G. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed to bid on project in markets where the outdoor unit will see temperatures below freezing.

### **3.06 COMPRESSOR**

- A. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.
- B. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.
- C. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed. Manufacturers that utilize belly-band crankcase heaters will be considered as alternate only.
- D. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.
- E. The compressor shall be equipped with an internal thermal overload.
- F. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.
- G. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

### **3.07 CONTROLS**

- A. Outdoor unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand.
- B. The unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor e control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.
- C. The outdoor unit shall have the capability of 4 levels of demand control for each refrigerant system based on external input.

### **3.08 ELECTRICAL**

- A. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz or 460 volts, 3-phase, 60 hertz per equipment schedule.
- B. The outdoor unit shall be controlled by integral microprocessors.
- C. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

## **PART 4 – CONTROLS**

### **4.04 OVERVIEW**

- A. The control system shall consist of a low voltage communication network and a web-based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. Furnish energy conservation features such as optimal start, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
- C. System shall be capable of email generation for remote alarm annunciation.

### **4.02 ELECTRICAL CHARACTERISTICS**

- A. General:
  - 1. Variable
    - a. The VRF system shall communicate with the BAS using one of the following communications methods.

- 1) The VRF system and the BAS shall utilize ANSI®/ASHRAE® Standard 135 (BACnet) protocol revision 12 or greater.
  - 2) Recognizing that VRF manufacturers utilize proprietary protocols to pass information between VRF equipment components. A gateway device is an accepted method to convert proprietary data to BACnet data. BACnet data shall conform to BACnet protocol revision 12 or greater.
  - 3) When a device is capable of data exchange with the BACnet protocol across non-IP network segments, the BACnet protocol shall be used to exchange data. If a device does not support the BACnet protocol an alternative protocol may be used. Data exchanged using the alternative protocol shall be converted to the BACnet protocol to allow integration to the BAS.
- b. To promote BAS interoperability, each instance of the following VRF system components shall be visible to the BAS network as a virtual BACnet device.
- 1) Indoor equipment
  - 2) Outdoor equipment
  - 3) Refrigerant manifold devices
  - 4) Outdoor air ventilation systems
- c. Virtual BACnet device functionality shall conform to BACnet protocol revision 12 or greater and meet the minimum functionality defined by BACnet device profile B-ASC.

#### **4.03 WIRING TYPE**

- A. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by Trane/Mitsubishi.
- B. Network wiring shall be CAT-5 with RJ-45 connection.

#### **4.04 CITY MULTI CONTROLS NETWORK**

- A. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.

#### **4.05 CENTRALIZED CONTROLLER (WEB-ENABLED)**

- A. Variable Refrigerant Flow (VRF) Communications
- B. The VRF system shall communicate with the BAS shall utilize ANSI®/ASHRAE® Standard 135 (BACnet) protocol revision 12 or greater.
  1. The VRF system and the BAS shall utilize ANSI®/ASHRAE® Standard 135 (BACnet) protocol revision 12 or greater.
  2. Recognizing that VRF manufacturers utilize proprietary protocols to pass information between VRF equipment components. A gateway device is an accepted method to convert

proprietary data to BACnet data. BACnet data shall conform to BACnet protocol revision 12 or greater.

3. When a device is capable of data exchange with the BACnet protocol across non-IP network segments, the BACnet protocol shall be used to exchange data. If a device does not support the BACnet protocol an alternative protocol may be used. Data exchanged using the alternative protocol shall be converted to the BACnet protocol to allow integration to the BAS.
- C. To promote BAS interoperability, each instance of the following VRF system components shall be visible to the BAS network as a virtual BACnet device.
  1. Indoor equipment.
  2. Outdoor equipment.
  3. Refrigerant manifold devices.
- D. Virtual BACnet device functionality shall conform to BACnet protocol revision 12 or greater and meet the minimum functionality defined by BACnet device profile B-ASC.
- E. The VRF indoor equipment shall support wireless zone sensors. Sensing options shall include temperature, relative humidity, CO2, and occupancy. Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications.

#### **4.06 BUILDING / SYSTEM CONTROLLERS**

- A. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.
  1. The controller shall provide a USB communications port for connection to a PC.
  2. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
  3. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.
  4. Data shall be shared between networked System Controllers.
  5. Serviceability - The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
- B. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.

#### **4.07 BUILDING CONTROLLER SOFTWARE**

- A. Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, Historical Trend Logs and Trim and Respond. Manufacturer shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.

- B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.
  - 1. Trend Logs:
    - a. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.

#### **4.08 GRAPHICAL USER INTERFACE**

- A. Provide Building Controller Web Interface
  - 1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.
  - 2. The building controller web interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
  - 3. User Roles:
    - a. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
    - b. User login/logoff attempts shall be recorded.
    - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
  - 4. On-Line Help and Training
    - a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
    - b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.
  - 5. Equipment & Application Pages
    - a. The building controller web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
      - 1) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
      - 2) Historical Data for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
  - 6. Building Controller System Graphics.
    - a. The building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor

of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.

- b. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
  - c. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
  - d. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
7. Manual Control and Override
- a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
  - b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
  - c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
  - d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
8. Scheduling - The scheduling application shall provide graphical representation of the day, week, month and exception events.
9. Alarm/Event Notification
- a. Alarm/ Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
    - 1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
    - 2) The operator shall be able to acknowledge and add comments to alarms.
    - 3) Alarm/event messages shall use full language, easily recognized descriptors.
  - b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.
10. Reports and Logs
- a. The building operator web interface shall provide a reporting package that allows the operator to select reports.
  - b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.
  - c. The following standard reports shall be available without requiring a user to manually configure the report:

- 1) All Points in Alarm Report: Provide an on demand report showing all current alarms.
  - 2) All Points in Override Report: Provide an on demand report showing all overrides in effect.
  - 3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
  - 4) Points report: Provide a report that lists the current value of all points.
11. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.

## **PART 5 – VENTILATION OPTIONS**

### **5.01 GENERAL**

- A. The PAC-AH001-1 Linear Expansion Valve Kit shall be a dedicated custom package to allow the integration of CITYMULTI VRF with custom direction expansion coils selected in accordance with factory specifications. The package comprises of the following components:
1. PAC-AH001-1 Controller
  2. NEMA 1 Rated Control Panel Enclosure
  3. Linear Expansion Valves
    - a. PAC-LV24AC-1 (2 ton nominal)
    - b. PAC-LV48AC-1 (4 ton nominal)
    - c. PAC-LV60AC-1 (5 ton nominal)
    - d. PAC-LV96AC-1 (8 ton nominal)
    - e. PAC-LV120AC-1 (10 ton nominal)
  4. Thermistors TH-21/22/23/24 (return air, liquid line, suction line, supply air)
- B. Each Linear Expansion Valve shall be supplied with integrated power cable for termination at the PAC-AH001-1 control panel in the field.

### **5.02 CONTROL PANEL**

- A. The PAC-AH001-1 control panel shall be NEMA-1 or equivalent rated for installation indoor or in a suitably rated enclosure. The control panel shall be installed in the field in close proximity to the custom direct expansion coil (up to 16') to facilitate the field wiring of control and power wiring. The PAC-AH001-1 control panel shall have the following input/output terminals to facilitate interlocks and communication with third party control systems:
1. ON/OFF Input (A1-A2)
  2. Error Signal Output (E-E2)
  3. Operation Signal Output
    - a. Error Signal Output (OE)
    - b. Operation Signal Heating (OH)



- c. Operation Signal Cooling (OC)
- d. Operation Signal Defrost (OD)

### **5.03 ELECTRICAL**

- A. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hertz. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

### **5.04 CONTROLS**

- A. This unit shall use controls provided by Mitsubishi Electric Trane HVAC to perform functions necessary to operate the system. Please refer to the controls section of the LEV Control Box and Valve Assemblies Application Guide for details on controllers and other control options.
- B. Alternately, the PAC-AH001-1 Linear Expansion Valve Controller can be controlled using the 0-10 VDC analog input function (B1-B2) along with the other control contact points detailed previously.

## **PART 6 – HVAC EQUIPMENT ALTERNATE (GENERAL INFORMATION)**

- 6.01** The alternate equipment supplier shall provide to the bidding mechanical contractor a complete equipment data package. This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.

The mechanical contractor shall request and receive the equipment data package 15 days prior to bid date and submit this package with the alternate bid.

The mechanical contractor shall list the equipment supplier and submit the required data package with the bid detailing a complete comparison of the proposed alternate equipment to the specified equipment and the associated cost reduction of the alternate equipment. The contractor bids an alternate manufacturer with full knowledge that that manufacturer's product may not be acceptable or approved.

The alternate equipment supplier shall furnish a complete drawing package to the mechanical contractor 15 days prior to bid day for bidding and installation. The drawing format shall be .dxf or equivalent, on 30"x42" sheets. The HVAC and electrical series design documents

will be made available in electronic format for use by the equipment supplier in preparing their drawings. The alternate equipment supplier shall prepare the following drawings:

- XXXHVAC Floor Plan
- XXXHVAC Refrigerant Piping Plan
- XXXHVAC Refrigerant Piping/Controls Details
- XXXHVAC Details
- XXXHVAC Schedules

The alternate equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details and schedules for their System. The drawings shall convey all requirements to successfully install the alternate equipment supplier's system.

Provide (2) drawing package sets plotted on 20 lb. vellum. Provide (1) drawing package in electronic format (.dxf files) on CD.

The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.

END OF SECTION

**SECTION 26 01 00**  
**BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Civil, Architectural, Structural, and Mechanical documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.
  - 1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
  - 1. Refer to all sections in the general contract conditions, Contract Requirements and Division 1, General Requirements.
- C. Work Installed but Furnished by Others:
  - 1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

**1.02 GENERAL REQUIREMENTS**

- A. Guarantee See General Conditions:
  - 1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure, correct deficiency immediately and without additional cost to the Owner.
  - 2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Division 01.
- B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.

C. Codes and Regulations:

1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:
  - a. Institute of Electrical and Electronic Engineers - IEEE
  - b. National Electrical Manufacturers' Association - NEMA
  - c. Underwriters' Laboratories, Inc. - UL
  - d. National Fire Protection Association - NFPA
  - e. American Society for Testing and Materials - ASTM
  - f. American National Standards Institute - ANSI
  - g. California Electrical Code – CEC, Title 24, Part 3
  - h. California Code of Regulations, Title 8, Subchapter 5
  - i. California Building Code-CBC, Title 24 Parts 1 & 2
  - j. State & Municipal Codes in Force in the Specific Project Area
  - k. Occupational Safety & Health Administration – OSHA
  - l. California State Fire Marshal
  - m. California Fire Code- CFC, Title 24 Part 9
  - n. National Electrical Testing Association - NETA
2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.
  - a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.
  - b. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.

E. Shop Drawings:

1. See Division 01 for additional requirements.
2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.

3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.
  4. Submit a complete list of materials and equipment proposed for the job, including manufacturers names and catalog numbers.
  5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.
    - a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.
    - b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.
    - c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.
    - d. Include complete catalog information such as construction, ratings, insulation systems, as applicable.
    - e. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.
    - f. Reference listings to the specifications' Sections and Article to which each is applicable.
    - g. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical and mechanical equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale.
  6. Contractor shall prepare coordinated drawings when required by Division 01 or where noted otherwise.
- F. Interpretations: The Contractor through the Architect must make Requests for interpretations of drawings and specifications. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.
- G. Standard of Quality
1. The contract Drawings and Specifications establish the "MINIMUM STANDARD OF QUALITY" each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the "MINIMUM STANDARD OF QUALITY" established by this Contract Document.

- H. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:
1. General Requirements:
    - a. Panelboards.
    - b. Switchboards.
    - c. Conduits
    - d. Conductors, include all selected insulation types.
    - e. Fuses
    - f. Disconnect switches and Starters.
    - g. Pullboxes, manholes and handholes.
    - h. Control devices, standard and special receptacles, switches, outlets and finish device plates.
    - i. Cabinets for signal and telephone system, special terminals and cabinets. Include all cabinet dimensions.
    - j. Dry Type Voltage Transformers.
  - I. Record Drawings: Refer to Division 01, Contract Closeout.
  - J. Work Responsibilities:
    1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work. Where conflicts occur in plans and/or specifications, the most stringent application shall apply and shall be part of the base bid.
    2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect.
    3. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.
    4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.
    5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.
    6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.

7. Contractor shall be responsible for coordination of coordinated drawings when required by the Architect.
  8. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.
- K. Installation General: For special requirements, refer to specific equipment under these requirements.
1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
  2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.
  3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
  4. Type of Sleeves: Refer to Section 260500.
  5. Wherever conduit extends through roof, install flashings in accordance with drawings and details.
  6. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.
  7. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.
  8. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.
  9. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
  10. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.
  11. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, switchgear and panels and junction boxes prior to pulling any conductors.

12. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.
- L. Excavation, Cutting and Patching:
1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 31. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.
  2. Verify openings indicated on the drawings. Provide all cutting, patching and reinforcement of the construction of the building as required to install electrical work.
- M. Tests
1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
  2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.
  3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.
  4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the engineer a report showing the results of these measurements.
  5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Architect. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.
  6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
  7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.



- N. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.
- O. Cleaning Up:
1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.
  2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
  3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
  4. Leave the entire installation in a clean condition.
- P. Completion:
1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
  2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.
- Q. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Division 01
- R. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.
- S. Final Completion of Electrical Systems:
1. Prior to Final Completion of operating electrical systems, the Contractor shall:
    - a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
    - b. Deliver to the Architect, the Record Documents per 1.3 of this section.
    - c. Furnish the required Operating and Maintenance Data/Manuals.
    - d. Clean up of the project pertaining to this Division of the work.
    - e. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.

- f. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
  - g. Submission of warranties and guarantees.
- 2. Final Completion of Work Shall be Contingent On:
  - a. Contractor replacing defective materials and workmanship.
  - b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
  - c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.
  - d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.
- T. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.
- U. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of all equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

### **1.03 PROJECT RECORD DOCUMENTS**

- A. Record Drawings: CAD: Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Acceptable CAD systems shall be capable of producing files in AutoCAD Version 2018 compatible DWG or DXF format. Owner's consultant will furnish CAD backgrounds for use by the Contractor after construction is 85% complete except where prohibited by Contract.
- B. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.
- C. Quantity:
  - 1. Review sets: As for Shop and Field Drawings.

2. Record set: Three (3) blackline.
- D. Format: Record Drawings:
1. Disk copy of Record Drawings - 1 copy of each drawing file in format noted above, CD-ROM.
- E. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.
- F. Warranty Certificates: Comply with Division 01.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

Not Used

END OF SECTION

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## **SECTION 26 01 60 CABINETS AND ENCLOSURES**

### **PART 1 - GENERAL**

#### **1.01 WORK INCLUDED**

- A. Hinged cover enclosures.
- B. Cabinets.
- C. Terminal blocks and accessories.

#### **1.02 REFERENCES**

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NEMA ICS 1 - Industrial Control and Systems.
- C. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
- D. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems.

#### **1.03 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Shop Drawings for Equipment Panels: Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.

### **PART 2 - PRODUCTS**

#### **2.01 HINGED COVER ENCLOSURES**

- A. Construction: NEMA 250; Type 1, 3R, steel.
- B. Finish: Manufacturer's standard enamel finish.
- C. Covers: Continuous hinge, held closed by flush latch operable by key.
- D. Panel for Mounting Terminal Blocks or Electrical Components: 14 gage steel, white enamel finish.

#### **2.02 CABINETS**

- A. Cabinet Boxes: Galvanized steel with removable endwalls. Provide 3/4 inch thick plywood backboard painted matte white, for mounting terminal blocks.
- B. Cabinet Fronts: Steel, flush surface type with concealed trim clamps, screw cover front, concealed hinge and flush lock keyed to match branch circuit panelboard; finish as approved by Architect.

#### **2.03 TERMINAL BLOCKS AND ACCESSORIES**

- A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.
- B. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.

- C. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

#### **2.04 FABRICATION**

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs knockouts on enclosures.
- C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.
- B. Provide accessory feet for free-standing equipment enclosures.
- C. Install trim plumb.
- D. Provide nameplate per Section 26 05 32.
- E. Ground and bond per Section 26 05 26.

END OF SECTION

**SECTION 26 04 40**  
**DISCONNECT SWITCHES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Disconnect switches.
- B. Fuses.
- C. Enclosures.

**1.02 REFERENCES**

- A. ANSI/UL 198C - High-Intensity Capacity Fuses; Current Limiting Types.
- B. ANSI/UL 198E - Class R Fuses.
- C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
- D. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- E. NEMA KS 1 - Enclosed Switches.
- F. C.E.C. California Electrical Code.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS - DISCONNECT SWITCHES**

- A. Square D
- B. Eaton Cutler-Hammer.
- C. GE.

**2.02 DISCONNECT SWITCHES**

- A. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: FS W-F- 870.
- B. Enclosures: NEMA KS 1; Type 1, for interior dry locations; Type 3R for exterior or wet locations. Furnish 1 padlock and two keys for each disconnect, Master 611 or M-20.
- C. Switch Ratings: Number of poles, voltage, current and horsepower rating as required for particular installation.

**2.03 ACCEPTABLE MANUFACTURERS - FUSES**

- A. Littelfuse.
- B. Gould Shawmut.
- C. Bussman.

## **2.04 FUSES**

- A. Fuses 600 Amperes and Less: ANSI/UL 198E, Class RK1; current limiting, one-time fuse, 250 volt.
- B. Interrupting Rating: 200,000 rms amperes.
- C. Size fuses based on motor nameplate rating.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install disconnect switches where indicated on Drawings.
- B. Install fuses in fusible disconnect switches, otherwise required by Code.
- C. Properly align switches and support independent of the connecting raceway.

END OF SECTION



**SECTION 26 05 00**  
**COMMON WORK RESULTS FOR ELECTRICAL**

**PART 1 - GENERAL**

**1.01 SUMMARY**

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

**1.02 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

**1.03 SUBMITTALS**

- A. Product Data: For sleeve seals.

**1.04 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."

## **PART 2 - PRODUCTS**

### **2.01 SLEEVES FOR RACEWAYS AND CABLES**

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

### **2.02 SLEEVE SEALS**

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

### **2.03 GROUT**

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

## **PART 3 - EXECUTION**

### **3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

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

### **3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### **3.03 SLEEVE-SEAL INSTALLATION**

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

### **3.04 FIRESTOPPING**

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

END OF SECTION

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Building wire and cable.
- B. Wiring connectors and connections.

**1.02 REFERENCES**

- A. ANSI/NFPA 70 – California Electrical Code.
- B. C.E.C. – California Electrical Code.
- C. InterNational Electrical Testing Association.
- D. OSHA, Definition B, 29 CFR 1910.7.

**1.03 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

**1.04 REGULATORY REQUIREMENTS**

- A. Conform to requirements of C.E.C.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

**1.05 PROJECT CONDITIONS**

- A. Verify that field measurements are as shown on Drawings.
- B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required meeting Project Conditions.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

**1.06 COORDINATION**

- A. Determine required separation between cable and other work.
- B. Determine cable routing to avoid interference with other work.

**PART 2 - PRODUCTS**

**2.01 BUILDING WIRE AND CABLE**

- A. Description: Single conductor insulated wire, new, manufactured not more than 6 months prior to installation, with size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
- B. Conductor: Copper.

- C. Insulation Voltage Rating: 600 volts.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

### **3.02 PREPARATION**

- A. Completely and thoroughly swab raceway before installing wire.

### **3.03 WIRING METHOD**

- A. Type THHN/THWN insulation for dry interior locations, in raceway.
- B. Type THWN for exterior or wet locations, in raceway.

### **3.04 INSTALLATION**

- A. Provide conductors continuous from outlet to outlet and splice only at outlet or junction boxes.
- B. Circuit all feeders and branch circuits as shown on the drawings. Suggested deviation from the plans must be provided by the Architect.
- C. Install products in accordance with manufacturers instructions.
- D. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- E. Use stranded conductors for control circuits.
- F. Use conductor not smaller than 12 AWG for power and lighting circuits.
- G. Use conductor not smaller than 16 AWG for control circuits.
- H. Low voltage control wiring shall be No. 18 AWG minimum, insulated cable for each conductor. Voltage rating of cable shall be suitable for either Class I or Class II, remote control or signal circuit, as determined by the code and the actual installation.
- I. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (450-m).
- J. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (600-m).
- K. Install all conductors in a single raceway at one time, insuring that conductors do not cross one another while being pulled into raceway. Leave sufficient cable at all fittings or boxes and prevent conductor kinks. Keep all conductors within the allowable tension and exceeding the minimum-bending radius.
- L. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Lubricants for wire pulling shall conform to UL requirements for the insulation and raceway material.
- M. Provide conductor supports as required by Code and recommended by the cable manufacturer. Where required, provide cable supports in vertical conduits similar to OZ Gedney Type CMT and provide the lower end of conduit with OZ Gedney Type KVF ventilators.
- N. No splicing or joints will be permitted in either feeder or branch circuits except at outlet or accessible junction boxes.

- O. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- P. Clean conductor surfaces before installing lugs and connectors.
- Q. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Keep splices in underground junction boxes, handholes, and manholes to an absolute minimum. Where splices are necessary, use resin pressure splices and resin splicing kits manufactured by the 3M Company to totally encapsulate the splice. Arrange the splicing kit to minimize the effects of moisture.
- R. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- S. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- T. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- U. Provide all power and control conductors, that terminate on equipment or terminal strips, with solderless lugs or tork and flanged tongue terminals. Provide T & B "Sta-kon" tongue terminal. This type conductor termination is not required when the equipment is provided with solderless connectors.

### 3.05 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Division 26.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.
- C. Conductor Identification: All branch circuit conductors (No. 10 AWG and smaller) throughout the project shall be provided with color-coded insulation as follows:

208Y/120V	Phase	480Y/277
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

- D. Conductors No. 8 and larger shall be black with bands of colored nonaging, plastic tape to color code the conductors, utilizing the same scheme as for branch circuits. The bands shall occur within each enclosure where a tap, splice or termination is made.
- E. Color code all control wire insulation and label each termination.

### 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION



**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

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

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Test wells.
  - 2. Ground rods.
  - 3. Ground rings.
  - 4. Grounding arrangements and connections for separately derived systems.
  - 5. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
  - 1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS and CEC Article 250.
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

**1.03 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. 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.
- C. Comply with UL 467 for grounding and bonding materials and equipment.
- D. Comply with the California Electrical Code (CEC).

## **PART 2 - PRODUCTS**

### **2.01 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - 5. Bonding Conductor: No. 4 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

### **2.02 CONNECTORS**

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

### **2.03 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
  - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
  - 2. Backfill Material: Electrode manufacturer's recommended material.

## **PART 3 - EXECUTION**

### **3.01 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
  - 1. Bury at least 24 inches (600 mm) below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- E. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### **3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS**

- A. Comply with IEEE C2 grounding requirements and CEC Article 250.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

### 3.03 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits sized per C.E.C. Table 250-122.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in ¾" (19mm) raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.04 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
  1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
  2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
  1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
  1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed,

- connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column and where indicated on the drawings.
  - 1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
  - 2. Bury ground ring (where indicated) not less than 24 inches (600 mm) from building foundation.
- J. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC, using a minimum of 40 feet (12 meters) of bare copper conductor not smaller than No. 4/0 AWG.
  - 1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
  - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

### **3.05 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following tests and inspections and prepare test reports:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

- b. Perform tests by fall-of-potential method according to IEEE 81.
- 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
  - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
  - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohms.
  - 5. Substations and Pad-Mounted Equipment: 5 ohms.
  - 6. Manhole Grounds: 10 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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**SECTION 26 05 29**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
  - 1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

**1.02 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

**1.04 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Nonmetallic slotted channel systems. Include Product Data for components.
  - 4. Equipment supports.



- C. Welding certificates.

#### **1.05 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with California Electrical Code (CEC).

#### **1.06 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### **PART 2 - PRODUCTS**

#### **2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit.
  - b. Cooper B-Line, Inc.; a division of Cooper Industries.
  - c. Fabco Plastics Wholesale Limited.
  - d. Seasafe, Inc.
3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2) Empire Tool and Manufacturing Co., Inc.
  - 3) Hilti Inc.
  - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
  - 5) MKT Fastening, LLC.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

## **2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

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

## **PART 3 - EXECUTION**

### **3.01 APPLICATION**

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by CEC. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### **3.02 SUPPORT INSTALLATION**

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

### **3.03 INSTALLATION OF FABRICATED METAL SUPPORTS**

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

### **3.04 CONCRETE BASES**

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete or Cast-in-Place Concrete (Limited Applications)" as applicable.
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturers written instructions.

### **3.05 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

**SECTION 26 05 32**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Nameplates.
- B. Wire and cable markers.

**1.02 SUBMITTALS**

- A. Submit shop drawings under provisions of Division 01.
- B. Include schedule for nameplates and tape labels.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- D. Embossed tape will not be permitted for any application.

**3.02 WIRE IDENTIFICATION**

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with panel and branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams equipment manufacturer's shop drawings for control wiring.

**3.03 NAMEPLATE ENGRAVING**

- A. Provide nameplates to identify all circuits in the service distribution and power distribution panelboards; branch circuit panelboards; separately mounted starting switches; disconnecting switches; motor control push-button stations; selector switches; terminal cabinets; telephone cabinets, etc. Clearly identify on the nameplate the equipment such as "Air Handling Unit AH-1" and "Hot Water Cir. Pump P-1" in lieu of abbreviated plan references such as "AH-1" or "P-1".
- B. Provide nameplates of minimum letter height as scheduled below.

- C. Panelboards and Switchboards: 1/4 inch; identify equipment designation, voltage rating, and source.
- D. Individual Circuit Breakers In Panelboards and Switchboards: 1/8 inch; identify circuit and load served, including location.
- E. Individual Circuit Breakers, Enclosed Switches and Motor Starters: 1/8 inch; identify voltage rating, ampere rating and load served including location.
- F. HVAC and Plumbing Control Equipment: 1/8 inch; identify equipment designation and equipment served including location.
- G. Communication Terminal Cabinets: 1/4 inch; identify cabinet designation and type of system.

END OF SECTION

**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

**1.02 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

**1.03 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
  - 2. For handholes and boxes for underground wiring, including the following:
    - a. Duct entry provisions, including locations and duct sizes.
    - b. Frame and cover design.
    - c. Grounding details.
    - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    - e. Joint details.
- C. Samples for Initial Selection: For wireways and surface raceways with factory-applied texture and color finishes.
  - 1. Size: 12" (300mm).
- D. Samples for Verification: For each type of exposed finish required for wireways and surface raceway, prepared on Samples of size indicated below.



1. Size: 12" (300mm).
- E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  1. Structural members in the paths of conduit groups with common supports.
  2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- F. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." 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 cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, 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.
- G. Qualification Data: For professional engineer and testing agency.
- H. Source quality-control test reports.

#### **1.04 QUALITY ASSURANCE**

- A. 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.

### **PART 2 - PRODUCTS**

#### **2.01 METAL CONDUIT AND TUBING**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AFC Cable Systems, Inc.
  2. Alflex Inc.
  3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.
  6. Manhattan/CDT/Cole-Flex.
  7. Maverick Tube Corporation.
  8. O-Z Gedney; a unit of General Signal.
  9. Wheatland Tube Company.
- C. Rigid Steel Conduit: ANSI C80.1.
  - D. Aluminum Rigid Conduit: ANSI C80.5.
  - E. IMC: ANSI C80.6.
  - F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
    1. Comply with NEMA RN 1.
    2. Coating Thickness: 0.040 inch (1 mm), minimum.
  - G. EMT: ANSI C80.3.
  - H. FMC: Zinc-coated steel.
  - I. LFMC: Flexible steel conduit with PVC jacket.
  - J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
    1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
    2. Fittings for EMT: Steel, raintight compression with integral insulated throat.
    3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
  - K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

## **2.02 NONMETALLIC CONDUIT AND TUBING**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AFC Cable Systems, Inc.
  2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  3. Arnco Corporation.
  4. CANTEX Inc.
  5. CertainTeed Corp.; Pipe & Plastics Group.
  6. Condux International, Inc.
  7. ElecSYS, Inc.

- 8. Electri-Flex Co.
- 9. Lamson & Sessions; Carlon Electrical Products.
- 10. Manhattan/CDT/Cole-Flex.
- 11. RACO; a Hubbell Company.
- 12. Thomas & Betts Corporation.
- C. ENT: NEMA TC 13.
- D. RNC: NEMA TC 2, Type EPC-80-PVC, unless otherwise indicated.
- E. LFNC: UL 1660.
- F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: UL 514B.

### **2.03 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Arnco Corporation.
  - 2. Endot Industries Inc.
  - 3. IPEX Inc.
  - 4. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Comply with UL 2024; flexible type, approved for riser installation.

### **2.04 METAL WIREWAYS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Square D; Schneider Electric.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated on drawings or as required for specific installation.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: Screw-cover type or Flanged-and-gasketed type for specific installation to maintain NEMA rating.
- F. Finish: Manufacturer's standard enamel finish.

## **2.05 NONMETALLIC WIREWAYS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hoffman.
  - 2. Lamson & Sessions; Carlon Electrical Products.
  - 3. Or approved equal.
- C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## **2.06 SURFACE RACEWAYS**

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect in areas not exposed to public view or Prime coating, ready for field painting where exposed to public view.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Thomas & Betts Corporation.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Not permitted on project.

## **2.07 BOXES, ENCLOSURES, AND CABINETS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.

3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- F. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- G. Nonmetallic Floor Boxes: Not permitted on project.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- K. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.

## **2.08 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING**

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

5. Cover Legend: Molded lettering, as indicated for each service.
  6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. NewBasis.
    - e. Brooks.
- C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of reinforced concrete.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

## **2.09 SLEEVES FOR RACEWAYS**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."

## **2.10 SLEEVE SEALS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## **2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES**

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by a independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## **PART 3 - EXECUTION**

### **3.01 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid steel conduit.
  - 2. Concealed Conduit, Aboveground: EMT.
  - 3. Underground Conduit: RNC, Type EPC-Schedule 40-PVC, direct buried.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
  - 6. Application of Handholes and Boxes for Underground Wiring:
    - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Traffic rated steel.
    - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Traffic rated steel.
    - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Traffic rated steel.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed and Subject to Physical Damage: IMC. Includes but not limited to, raceways in the following locations:
    - a. Shop Areas.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
    - d. Kitchen Areas.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 6. Damp or Wet Locations: IMC.
  - 7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT unless otherwise noted on drawings.
  - 8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
  - 9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
  - 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size for above ground and 1 inch trade size for below grade.



- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

### **3.02 INSTALLATION**

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
  - 1. Not Allowed
  - 2. Change from RNC, Type EPC-80-PVC to PVC coated rigid steel conduit, or IMC before rising above the floor through slab.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Provide permanent nameplate tags identifying location of other end of raceway.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
  - 1. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).

2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where otherwise required by CEC.
- N. Expansion-Joint Fittings for RNC: Not permitted on project.
- O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Set metallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- S. Coordinate with Architectural drawings for tackable wallboards and install box rings so that no space exists between device and wall plate.
- T. No non-metallic conduit is allowed above grade.

### **3.03 INSTALLATION OF UNDERGROUND CONDUIT**

- A.
1. Install top of duct bank minimum 24 inches (600mm) below finished grade. Adjust depth to avoid interference with gravity flow systems of any kind. Maintain minimum 12 inches (300mm) clearance between duct bank and any gravity flow system.
  2. Duct lines shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 4 inches (100mm) in 100 feet (300m). Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet (50m), except that manufactured bends may be used at ends of short runs of 100 feet (300mm) or less, and then only at or close to the end of run.
  3. Terminate conduit in end bell at manhole and pullbox entries.
  4. Use suitable separators and chairs installed not greater than 4 feet (25m) on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete or slurry placement.
  5. Provide minimum 3 inches (75mm) concrete 2 sack slurry cover at bottom, top, and sides of duct bank. Refer to Division 3 section for additional information.
  6. Provide two No. 4 steel reinforcing bars in top of bank under paved driving areas.

7. Encase non-metallic primary and secondary feeders, telephone, fire alarm communications and data conduit installed underground 2 inches (50-mm) or larger in a concrete or slurry duct bank unless noted otherwise in the Contract Documents. Space the external surfaces of conduit within a bank a minimum of 3 inches (75-mm) apart except that sound, telephone, data and intercommunication circuits contained within non-metallic conduit shall have a minimum separation of 12 inches (300-mm) from any light or power circuits that parallel them within a bank. Use appropriate manufactured plastic spacers to insure the minimum required concrete or slurry coverage. All concrete or slurry duct conduit banks shall contain a warning tape 12 inches (300-mm) above ductbank.
8. Numbers and sizes of ducts shall be as indicated. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Manufactured steel 90-degree duct bends shall be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches (450-mm) for ducts of less than 3-inch (75-mm) diameter, and 36 inches (900-mm) for ducts 3 inches (75mm) in diameter 48 inches (1.2-m) for ducts or greater in diameter unless noted otherwise in the Contract Documents. Long sweep bends having a minimum radius of 25 feet (75-m) shall be used for a change of direction of more than 5 degrees, horizontally or vertically. Both curved and straight sections shall be used to form long sweep bends as required, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes, pullboxes or handholes. Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In lieu of markers, a 5-mil brightly colored plastic tape not less than 3 inches (75-mm) in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion resistant 1-mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches (300mm) below finished grade levels of such lines.
9. Ducts shall be kept clean of concrete or slurry, dirt or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. After a duct line is completed, a standard flexible mandrel shall be used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches (300-mm) long and have diameters 1/4 inch (6.2-mm) less than the inside diameter of the duct being cleaned. Pneumatic rodding may be used to draw in lead wires. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

### **3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade in unpaved areas.
- D. Install handholes and boxes with bottom depth as required to meet elevation of incoming conduits.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### **3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### **3.06 SLEEVE-SEAL INSTALLATION**

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

### **3.07 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Penetration Firestopping."

### **3.08 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

**SECTION 26 05 48**  
**VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Spring isolators.
  - 2. Restrained spring isolators.
  - 3. Channel support systems.
  - 4. Restraint cables.
  - 5. Hanger rod stiffeners.
  - 6. Anchorage bushings and washers.
- B. Related Sections include the following:
  - 1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

**1.02 DEFINITIONS**

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.
- D. CEC: California Electrical Code.
- E. CBC: California Building Code.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Seismic-Restraint Loading:
  - 1. Electrical equipment shall be seismically anchored to conform to C.C.R. Title 24, 2016 CBC Section 1616A.1.24, Anchorage details not shown on the approved plans or otherwise approved by DSA are subject to field approval by the Architect and/or Structural Engineer of record and field approval by DSA. All conduits shall be supported and braced in accordance with SMACNA Guidelines, the CEC and as approved by DSA.

**1.04 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
- B. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

- C. Welding certificates.
- D. Qualification Data: For Testing Agency.
- E. Field quality-control test reports.

#### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (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: 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 OPM 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 not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- E. Comply with CEC.

### **PART 2 - PRODUCTS**

#### **2.01 VIBRATION ISOLATORS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
  - 1. Ace Mountings Co., Inc.
  - 2. Amber/Booth Company, Inc.
  - 3. California Dynamics Corporation.
  - 4. Isolation Technology, Inc.
  - 5. Kinetics Noise Control.
  - 6. Mason Industries.
  - 7. Vibration Eliminator Co., Inc.
  - 8. Vibration Isolation.
  - 9. Vibration Mountings & Controls, Inc.

- D. Pads : Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment. Refer to drawing details for locations.
  - 1. Resilient Material: Oil- and water-resistant neoprene.

## **2.02 SEISMIC-RESTRAINT DEVICES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation.
  - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 4. Hilti Inc.
  - 5. Loos & Co.; Seismic Earthquake Division.
  - 6. Mason Industries.
  - 7. TOLCO Incorporated; a brand of NIBCO INC.
  - 8. Unistrut; Tyco International, Ltd.
- D. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to DSA.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least 4 times the maximum seismic forces to which they will be subjected.
- E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- F. Restraint Cables: ASTM A 603 galvanized steel cables in concealed spaces and ASTM A 492 stainless-steel cables in areas exposed to view in public spaces. Both shall have end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- G. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- H. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- I. 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.



- J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- K. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- L. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## **2.03 FACTORY FINISHES**

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  - 1. Powder coating on springs and housings.
  - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
  - 3. Baked enamel or powder coat for metal components on isolators for interior use.
  - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## **PART 3 - EXECUTION**

### **3.01 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.
- 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.

### **3.02 APPLICATIONS**

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

### **3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION**

- A. Equipment and Hanger Restraints:
  - 1. Install restrained isolators on electrical equipment.

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by DSA.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
  1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid 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.

### **3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION**

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

### **3.05 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- 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. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### **3.06 ADJUSTING**

- A. Adjust isolators after isolated equipment 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.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

**SECTION 26 05 72**  
**ACCEPTANCE TESTING**

**PART 1- GENERAL**

**1.01 It is the intent of these acceptance tests to assure that all Contractor supplied equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with designed specifications.**

- A. The acceptance tests and inspections shall determine suitability for energization of switchgear and cables.
- B. Items that shall be checked, inspected, and tested include, but are not limited to, the following:
  - 1. Relays.
  - 2. Power/Lighting panelboards.
  - 3. 600V rated cable.
  - 4. Lighting System

**1.02 APPLICABLE CODES**

- A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
  - 1. California Electrical Code - CEC 2016 Edition.
  - 2. National Electrical Manufacturer's Association - NEMA.
  - 3. American Society for Testing and Materials - ASTM.
  - 4. Institute of Electrical and Electronic Engineers - IEEE.
  - 5. National Electrical Testing Association - NETA.
  - 6. American National Standards Institute - ANSI:
    - a. C2, National Electrical Safety Code
    - b. Z244-1, American National Standard for Personnel Protection
  - 7. State Codes and Ordinances.
  - 8. Insulated Cable Engineers Association - ICEA.
  - 9. Association of Edison Illuminating Companies - AEIC.
  - 10. Occupational Safety and Health Administration:
    - a. Part 1910, Subpart S, 1910.308
    - b. Part 1926, Subpart V, 1926.950 through 1926.960
  - 11. National Fire Protection Association - NFPA:
    - a. CEC, Electrical Equipment Maintenance
    - b. CEC, Electrical Safety Requirements for Employee Workplaces
    - c. ANSI/NFPA 70, California Electrical Code 2016 Edition
    - d. ANSI/NFPA 78, Lightning Protection Code

- e. ANSI/NFPA 101, Life Safety Code
- f. 2016 Title 24 Energy Guidelines, Chapter 8
- 12. All inspections and tests shall utilize the following references:
  - a. Project Design Specification.
  - b. Project Design Drawings.
  - c. Manufacturer's instruction manuals applicable to each particular apparatus.

### **1.03 QUALIFICATIONS OF TESTING AGENCY**

- A. The testing firm shall be an independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The testing firm and all the testing personnel shall have been engaged in such practices for a minimum of ten years.
- D. The testing firm shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910, and 1936. Full membership in the National Electrical Testing Association constitutes proof of such criteria.
- E. The lead, on site, technical person shall be currently certified by the National Electrical Testing Associate (NETA) in Electrical Power Distribution System Testing.
- F. Testing firm shall utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians may assist, but may not perform testing and/or inspection services.
- G. The testing firm shall submit proof of the above qualifications.
- H. The testing firm shall be an independent organization as defined by OSHA Title 29, Part 1936 and the National Electrical Testing Association.
- I. All instruments used by the testing firm to evaluate electrical performance shall meet NETA's Specifications for Test Instruments. (See Section 1.7 of this specification).
- J. The terms used herewith such as Test Agency, Testing Laboratory, or Contractor Test Company, shall be construed to mean testing firm.

### **1.04 RESPONSIBILITIES**

- A. The Contractor shall notify the Owners Representative prior to commencement of any testing.
- B. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported.
- C. The testing firm shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.
- D. A stable source of 60 hertz power shall be provided for testing purposes by the Contractor. Owners Representative shall witness all tests and a minimum of 14 days notice shall be provided.

### **1.05 TEST EQUIPMENT**

#### **A. Test Instrument Calibration**

1. The testing firm shall have a calibration program that assures that all applicable test instrumentation is maintained within rated accuracy.
2. The accuracy shall be directly traceable to the National Bureau of Standards.
3. Instruments shall be calibrated in accordance with the following frequency schedule:
  - a. Field instruments: Analog - 6 months maximum  
Digital - 12 months maximum
  - b. Laboratory Instruments – 2 months
  - c. Leased specialty equipment - 12 months (where accuracy is guaranteed by lessor)
4. Dated calibration labels shall be visible on all test equipment.
5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.
6. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.
7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

### **1.06 TEST REPORTS**

#### **A. The test report shall include the following:**

1. Summary of project.
2. Description of equipment/device tested.
3. Description of test, including date, time, and duration of test.
4. Test results.
5. Conclusions and recommendations.
6. Appendix, including appropriate test forms.
7. Identification of test equipment used.
8. Signature of responsible test organization authority.
9. Signature of the person witnessing the tests.
10. Furnish five copies of the complete report to the Owners Representative no later than thirty (30) days after completion of project unless otherwise directed.

### **1.07 SAFETY AND PRECAUTIONS**

#### **A. Safety practices shall include, but are not limited to, the following requirements:**

1. Occupational Safety and Health Act of 1970 - OSHA.
2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
3. Applicable State safety operating procedures.
4. NETA Safety/Accident Prevention Program.
5. District's safety practices.

6. National Fire Protection Association - NFPA 70E.
  7. ANSI Z244.1 American National Standards for Personnel Protection.
- B. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
  - C. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

## **PART 2 – NOT USED**

## **PART 3 - EQUIPMENT VERIFICATIONS, TESTS AND CALIBRATIONS**

### **3.01 GENERAL**

- A. As part of the contract, the Contractor shall perform tests of installed work as herein specified and specified in other Sections of these Specifications.
- B. The Contractor shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections.
- C. All tests shall be performed in compliance with the recommendations and requirements of the National Electrical Testing Association, Inc. (NETA), and applicable codes and standards.
- D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the service company responsible.
- C. The test and inspections shall determine suitability for continued reliable operation.
- D. All tests shall be conducted in the presence of the Owners Representative. Provide a minimum of two weeks notice to the Owners Representative.
- E. Furnish the necessary equipment and personnel to perform all required tests of all wiring and connections for continuity, short circuit, and improper grounds. Included, but not limited to, the following systems: substations, air interrupting switches, low voltage main and feeder circuit breakers, interlocking controls, panelboards, distribution transformers, branch circuits.

### **3.02 LOW VOLTAGE CIRCUIT BREAKERS**

- A. Visual and mechanical inspection:
  1. Inspect for physical condition.
  2. Inspect alignment and grounding.
  3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer's instructions.
  4. Perform insulation resistance test on control wiring.
  5. Clean mechanism, insulating surfaces and contacts.
- B. Electrical tests:
  1. Measure contact resistance.
  2. Trip overcurrent protective device by operation of each protective device.

3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.
4. Perform insulation resistance test in accordance with Doble procedure.
5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

### **3.03 CABLES, LOW VOLTAGE (600 VOLTS AND LESS)**

- A. Visual and mechanical inspections:
  1. Inspect cables for physical damage and proper connection.
  2. Torque test cable connection. Tighten connections in accordance with industry standards.
  3. Perform infrared scan of all connections under loaded conditions.
- B. Electrical tests:
  1. Perform insulation resistance test of each cable with respect to ground and adjacent cables.

### **3.04 GROUNDING SYSTEMS**

- A. Visual and mechanical inspection:
  1. Inspect ground system connections for completeness and adequacy.
- B. Electrical tests:
  1. Perform fall-of-the-potential test per IEEE No. 81, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or derived neutral points.

END OF SECTION



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## **SECTION 26 24 16**

### **PANELBOARDS**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Load centers.
  - 4. Transient voltage suppression panelboards.

##### **1.02 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

##### **1.03 SUBMITTALS**

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. UL listing for series rating of installed devices.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis of 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.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports including the following:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

#### **1.04 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- C. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- E. 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.
- F. Comply with NEMA PB 1.
- G. Comply with CEC.

#### **1.05 PROJECT CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not exceeding 104 degree F (40 degree C).
  - 2. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Architect and Owner no fewer than 14 days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Architects and Owners written permission.

#### **1.06 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### **1.07 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Six spares for each type of panelboard cabinet lock.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corporation; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Protection Div.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D.
  - 2. Transient Voltage Suppression Panelboards:
    - a. Current Technology.
    - b. Liebert Corporation.

### **2.02 MANUFACTURED UNITS**

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
  - 1. Rated for environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R unless noted otherwise.
    - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - d. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
  - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  - 6. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
  - 7. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
  - 8. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

9. Identifying nameplate with full description as specified in Section 260553.
- C. Phase and Ground Buses:
  1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
  3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
  4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
  5. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material.
  1. Main and Neutral Lugs: Compression type.
  2. Ground Lugs and Bus Configured Terminators: Compression type.
  3. Feed-Through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

### **2.03 PANELBOARD SHORT-CIRCUIT RATING**

- A. UL label indicating connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL connected short-circuit rating. Series rated panels and related circuit breakers are not acceptable.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

### **2.04 DISTRIBUTION PANELBOARDS**

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- B. Main Overcurrent Protective Devices: Circuit Breaker.
- C. Branch Overcurrent Protective Devices:
  1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on type circuit breakers.
  2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

### **2.05 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Branch Overcurrent Protective Devices: Bolt-on type circuit breakers, replaceable without disturbing adjacent units.

- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## **2.06 LOAD CENTERS**

- A. Overcurrent Protective Devices: Plug-in, full-module circuit breaker.
- B. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

## **2.07 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS**

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
- E. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
  - 1. Minimum Single-Impulse Current Ratings:
    - a. Line to Neutral: 100,000 A.
    - b. Line to Ground: 100,000 A.
    - c. Neutral to Ground: 50,000 A.
  - 2. Protection modes shall be as follows:
    - a. Line to neutral.
    - b. Line to ground.
    - c. Neutral to ground.
  - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
  - 4. Maximum Category C Combination Wave Clamping Voltage: 600 V, line to neutral and line to ground on 120/208 V. and 1000 V, line to neutral and line to ground on 277/480 V. systems.
  - 5. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V. and 800 V, line to neutral and line to ground on 277/480 V. systems.
  - 6. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
  - 7. Accessories:
    - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
    - b. Audible alarm activated on failure of any surge diversion module.
    - c. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

## **2.08 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
  2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  4. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
  5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
  6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
  7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
  10. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.



- D. Fuses are specified in Division 26 Section "Fuses."

## **2.09 CONTROLLERS**

- A. Motor Controllers: NEMA ICS 2, Class A, combination controller equipped for panelboard mounting and including the following accessories:
  - 1. Individual control-power transformers.
  - 2. Fuses for control-power transformers.
  - 3. Bimetallic-element overload relay.
  - 4. Indicating lights.
  - 5. Seal-in contact.
  - 6. 2 convertible auxiliary contacts.
  - 7. Push buttons.
  - 8. Selector switches.
- B. Contactors: NEMA ICS 2, Class A, combination controller equipped for panelboard mounting and including the following accessories:
  - 1. Individual control-power transformers.
  - 2. Fuses for control-power transformers.
  - 3. Indicating lights.
  - 4. Seal-in contact.
  - 5. 2 convertible auxiliary contacts or as otherwise indicated on drawings.
  - 6. Push buttons.
  - 7. Selector switches.
- C. Controller Disconnect Switches: Adjustable instantaneous-trip circuit breaker integrally mounted and interlocked with controller.
  - 1. Auxiliary Contacts: Integral with disconnect switches to de-energize external control-power source.
- D. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held general-purpose controller.
  - 1. Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
  - 2. Control-Power Source: 120-V branch circuit.

## **2.10 ACCESSORY COMPONENTS AND FEATURES**

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.
- C. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish. Where panelboards are recessed into fire rated walls, notify Architect immediately of condition and provide additional furring of wall (and related drywall) to bring panelboard front flush with finished surface.
- E. Install overcurrent protective devices and controllers.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub five 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing in a neat and professional manor.

### **3.02 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads (after balancing panelboard loads). Obtain approval from Architect of description or areas served before installing. The Contractor shall be responsible for updating directories to indicate actual area served which is not necessarily the description indicated on the bid documents. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws or rivets. Refer to Section 260553 for additional requirements.

### **3.03 CONNECTIONS**

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.04 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- D. Perform the following field tests and inspections and prepare test reports:
  1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  1. Measure as directed during period of normal system loading.
  2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
  1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
  2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### **3.05 CLEANING**

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris prior to pulling any conductors; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

## **SECTION 26 27 26 WIRING DEVICES**

### **PART 1 - GENERAL**

#### **1.01 WORK INCLUDED**

- A. Wall switches.
- B. Receptacles.
- C. Device plates and decorative box covers.
- D. Time switches.

#### **1.02 REFERENCES**

- A. NEMA WD 1 - General-Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.

#### **1.03 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

### **PART 2 - PRODUCTS**

#### **2.01 WALL SWITCHES**

- A. Single Pole Switch:
  - 1. Hubbell, Model 2121-W.
  - 2. Leviton, Model 5621-2W.
  - 3. Equal by Arrow Hart or Bryant.
- B. Double Pole Switch:
  - 1. Hubbell, Model 2122-W.
  - 2. Leviton, Model 5622-2W.
  - 3. Equal by Arrow Hart or Bryant.
- C. Three-way Switch:
  - 1. Hubbell, Model 2123-W.
  - 2. Leviton, Model 5623-3W.
  - 3. Equal by Arrow Hart or Bryant.
- D. Substitutions: Under provisions of Division 01.
- E. Description: NEMA WD 1, heavy-duty specification grade, AC only general-use quiet type rocker switch, UL approved for tungsten lamp loads or inductive loads without derating.
- F. Device Body: White plastic with rocker handle.
- G. Ratings: 20A., 120-277V A.C. or as required to match with specific branch circuit and load characteristics.
- H. Keyed switches shall be Leviton only per District standards.

## **2.02 RECEPTACLES**

- A. Duplex Convenience Receptacle:
  - 1. Hubbell
  - 2. Leviton
  - 3. Arrow Hart
  - 4. Bryant.
- B. GFCI Receptacle:
  - 1. Hubbell
  - 2. Leviton
  - 3. Arrow Hart
  - 4. Bryant.
- C. Surge Protected Outlets:
  - 1. Hubbell
  - 2. Leviton
  - 3. Arrow Hart
  - 4. Bryant.
- D. Substitutions: Under provisions of Division 01.
- E. Description: NEMA WD 1; heavy-duty general-use receptacle. 20 Amp, 125V, 2-pole, 3-wire style line series.
- F. Device Body: Plastic.
- G. Configuration: NEMA WD 6; type as specified and indicated.
- H. Convenience Receptacle: Type 5-20R
- I. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

## **2.03 WALL PLATES**

- A. Plates shall be brushed stainless steel and supplied for every local switch, receptacle, telephone and data outlet, wall speaker outlet, etc.
- B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
- C. Locking Weatherproof Cover Plate: Pass & Seymour #WP26-L or equal at locations Indicated on drawings.
- D. Plates shall be engraved and filled, when used for:
  - 1. More than two gangs.
  - 2. Equipment that cannot be seen from the locations.
  - 3. All lock type switches.
  - 4. All receptacles other than 120 volts.
  - 5. All pilot switches.
  - 6. Switches in locations from which the equipment or circuits controlled cannot be readily seen.
  - 7. Manual motor starting switches.
  - 8. Where so indicated on the drawings.
  - 9. As required on all control circuit switches, such as heater controls, etc.

## **2.04 TIME SWITCHES**

- A. Manufacturers:
  - 1. Tork.
  - 2. Paragon.
  - 3. Intermatic.
- B. Description: AC electronic time clock, 7-day.
- C. Input voltage: 120V.
- D. Poles: 40A, 120V, number as indicated. (4 pole minimum)
- E. Enclosure: Type as required to meet installation.
- F. Configuration: 365 Day Astronomic, electronic, programmable.
- G. Accessories: Photocell control as indicated.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### **3.02 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

### **3.03 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on top
- E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- F. Install decorative plates on switches, receptacles, etc., and blank outlets in finished areas.
- G. Connect wiring devices by wrapping conductor around screw terminal.
- H. Use jumbo size plates for outlets installed in masonry walls.
- I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished area, above accessible ceilings, and on surface mounted outlets.

### **3.04 INTERFACE WITH OTHER PRODUCTS**

- A. Coordinate locations of outlet boxes provided under Section 260533 to obtain mounting heights specified and indicated on drawings.

- B. Install wall switches as indicated on drawings.
- C. Install convenience receptacles 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above backsplash of counter.

### **3.05 FIELD QUALITY CONTROL**

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

### **3.06 ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

## **SECTION 26 28 13**

### **FUSES**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches panelboards and switchboards.
2. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
3. Spare-fuse cabinets.

##### **1.02 ACTION SUBMITTALS**

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
  - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

##### **1.03 CLOSEOUT SUBMITTALS**

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 00 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.



#### **1.04 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

#### **1.05 QUALITY ASSURANCE**

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. 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.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

#### **1.06 PROJECT CONDITIONS**

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 degree F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### **1.07 COORDINATION**

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Edison Fuse, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Littelfuse, Inc.

#### **2.02 CARTRIDGE FUSES**

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

#### **2.03 PLUG FUSES**

- A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

## **2.04 PLUG-FUSE ADAPTERS**

- A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

## **2.05 SPARE-FUSE CABINET**

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

# **PART 3 - EXECUTION**

## **3.01 EXAMINATION**

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.02 FUSE APPLICATIONS**

- A. Cartridge Fuses:
  - 1. Service Entrance: Class L, time delay.
  - 2. Feeders: Class RK1, time delay.
  - 3. Motor Branch Circuits: Class RK1, time delay.
  - 4. Other Branch Circuits: Class RK1, time delay Class J, time delay.

## **3.03 INSTALLATION**

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.
- C. Install spare-fuse cabinet(s).

### **3.04 IDENTIFICATION**

- A. Install labels complying with requirements for identification specified in Section 26 05 32 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

**SECTION 26 51 19**  
**LED INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes the following types of LED luminaires:
  - 1. Cylinder.
  - 2. Downlight.
  - 3. Highbay, linear.
  - 4. Linear industrial.
  - 5. Lowbay.
  - 6. Recessed linear.
  - 7. Strip light.
  - 8. Surface mount, linear.
  - 9. Surface mount, nonlinear.
  - 10. Suspended, linear.
  - 11. Suspended, nonlinear.
  - 12. Materials.
  - 13. Finishes.
  - 14. Luminaire support.

**1.02 DEFINITIONS**

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

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

6. Photometric data and adjustment factors based on laboratory tests[, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
  1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
  1. Include Samples of luminaires and accessories involving color and finish selection.
- E. Samples for Verification: For each type of luminaire.
  1. Include Samples of luminaires and accessories to verify finish selection.
- F. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### **1.04 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling plan(s) 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. Luminaires.
  2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  4. Structural members to which equipment and or luminaires will be attached.
  5. Initial access modules for acoustical tile, including size and locations.
  6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling-mounted projectors.

7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, 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.
- D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of luminaire.
- F. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.
- G. Sample warranty.

#### **1.05 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### **1.06 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. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### **1.07 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by 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, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
  1. Obtain Architect's approval of luminaires in mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### **1.09 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.01 PERFORMANCE REQUIREMENTS**

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

#### **2.02 LUMINAIRE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Standards:
  1. ENERGY STAR certified.
  2. California Title 24 compliant.
  3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
  4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
  5. UL Listing: Listed for damp location.
  6. Recessed luminaires shall comply with NEMA LE 4.
  7. User Replaceable Lamps:
    - a. Bulb shape complying with ANSI C78.79.
    - b. Lamp base complying with ANSI C81.61
- C. CRI of minimum 80. CCT of 4000 K.
- D. Rated lamp life of 50,000 hours to L70.

- E. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- F. Internal driver.
- G. Nominal Operating Voltage: 120 V ac 277 V ac.
  - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

## **2.03 MATERIALS**

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  - 1. Tempered Fresnel glass, prismatic glass, prismatic acrylic clear, UV-stabilized acrylic
  - 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 3. Glass: Annealed crystal glass unless otherwise indicated.
  - 4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

## **2.04 METAL FINISHES**

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

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

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



- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

### **3.03 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Comply with requirements in Section 260513 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### **3.04 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260532 "Identification for Electrical Systems."

### **3.05 FIELD QUALITY CONTROL**

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

### **3.06 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

### **END OF SECTION**





## **SECTION 26 56 19 LED EXTERIOR LIGHTING**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
  - 2. Luminaire supports.
  - 3. Luminaire-mounted photoelectric relays.

#### **1.02 DEFINITIONS**

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

#### **1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of luminaire.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaire.
  - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79, IES LM-80.
    - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
    - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
  - 6. Wiring diagrams for power, control, and signal wiring.
  - 7. Photoelectric relays.
  - 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.
- D. Product Schedule: For luminaires and lamps.
- E. Delegated-Design Submittal: For luminaire supports.
  - 1. Include design calculations for luminaire supports and seismic restraints.

#### **1.04 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Seismic Qualification Certificates: For luminaires, 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. Product Certificates: For each type of the following:
  - 1. Luminaire.
  - 2. Photoelectric relay.
- D. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.
- E. Source quality-control reports.
- F. Sample warranty.

#### **1.05 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
  - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

#### **1.06 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. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.

2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### **1.07 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by 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, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- E. Mockups: For exterior luminaires, complete with power and control connections.
  1. Obtain Architect's approval of luminaires in mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

#### **1.09 FIELD CONDITIONS**

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

#### **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures, including luminaire support components.
    - b. Faulty operation of luminaires and accessories.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

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

### **2.02 LUMINAIRE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61.
- F. Bulb shape complying with ANSI C79.1.
- G. CRI of minimum 80. CCT of 4000 K.
- H. L70 lamp life of 50,000 hours.
- I. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- J. Internal driver.
- K. Nominal Operating Voltage: 120 V ac 277 V ac.
- L. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- M. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- N. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

### **2.03 MATERIALS**

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum, Stainless steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

- D. Diffusers and Globes:
  - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage and coating.
    - c. CCT and CRI for all luminaires.

## **2.04 FINISHES**

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
  - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.



4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
  - a. Color: As noted on light fixture schedule.
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
  2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected from manufacturer's standard catalog of colors.
    - b. Color: Match Architect's sample of manufacturer's standard/custom color.
    - c. Color: As selected by Architect from manufacturer's full range.

## **2.05 LUMINAIRE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

### **3.03 GENERAL INSTALLATION REQUIREMENTS**

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.

### **3.04 CORROSION PREVENTION**

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260003 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### **3.05 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260532 "Identification for Electrical Systems."

### **3.06 FIELD QUALITY CONTROL**

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
  - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
    - a. IES LM-5.
    - b. IES LM-50.
    - c. IES LM-52.
    - d. IES LM-64.
    - e. IES LM-72.
  - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### **3.07 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

### **3.08 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit

occupied conditions. Make up to two Insert number visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

**END OF SECTION**

## **SECTION 31 10 00 SITE CLEARING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Clearing and protection of vegetation.
- B. Grubbing of root systems of trees and shrubs, abandoned utility lines and structures and other below grade obstructions and debris.
- C. Removal of existing debris.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 57 13 - Temporary Erosion and Sediment Control (SWPP).
- D. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- E. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- F. Section 02 41 00 - Demolition: Removal of built elements and utilities.
  - 1. Removal of paving and removal if indicated of abandoned utilities.
  - 2. Within building footprint, removal of designated walls, partitions, and other elements; capping and identifying utilities; and removal of concrete foundations.
  - 3. Sitework (Area of Work), removal of designated fences, walls, and other elements; capping and identifying utilities; landscape paving, and removal of concrete foundations.
- G. Section 31 23 16 - Excavation: Site preparation for structure and paving.
- H. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.
- I. Section 32 90 00 - Planting: Relocation of existing trees, shrubs, and other plants.

#### **1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
  - 1. Areas for temporary construction and field offices.

#### **1.04 QUALITY ASSURANCE**

- A. Clearing Firm: Company specializing in the type of work required.
  - 1. Minimum of five years of documented experience.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Fill Material: As specified in Section 31 23 23 - Fill and Backfill

## **PART 3 EXECUTION**

### **3.01 SITE CLEARING**

- A. Comply with other requirements specified in Section 01 70 00.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

### **3.02 SURVEY STAKING IN UNCLEARED EASEMENTS**

- A. Flag centerline of utility lines prior to clearing. Contractor shall set offsets for clearing limits to suit the Work.
- B. When the clearing is completed, survey for utility construction in accordance with requirements specified in Section 01 70 00 - Execution and Closeout Requirements.
- C. Contractor shall replace all controls and stakes damaged or destroyed, at no change in Contract Time or Contract Price.

### **3.03 EXISTING UTILITIES AND BUILT ELEMENTS**

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

### **3.04 CLEARING**

- A. Perform clearing Work within confines of Project area indicated on Drawings or specified elsewhere herein and with strict adherence to the Contract Documents and Geotechnical recommendations.

### **3.05 VEGETATION**

- A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, lawns, and planting beds.
- B. Do not begin clearing until vegetation to be relocated has been removed.
- C. Do not remove or damage vegetation beyond the limits indicated on drawings.
- D. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
  - 1. At vegetation removal limits.
- E. Remove only trees within area to be cleared that have been marked for removal. Confirm trees to be removed with Owner and Architect before beginning removal process.

1. Cut trunks close and parallel to ground.
  2. Remove roots where under or within five feet of proposed structures.
  3. Neither remove nor prune trees and shrubbery in public rights-of-way except by written approval of authorities having jurisdiction.
- F. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.
- G. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
  2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
  3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
  4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
- H. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.
- I. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

### **3.06 GRUBBING**

- A. At pipelines, remove all trees or stumps within five feet of the pipeline.
- B. Perform grubbing where indicated on Drawings or as specified herein. Grubbing shall include removal from the ground of all stumps, roots, buried logs and other vegetation not otherwise indicated to remain, and removal and disposal of resulting refuse.
- C. Completely grub areas where unsuitable surface material is to be removed.

### **3.07 DAMAGED VEGETATION**

- A. Neatly prune damaged branches and severed roots.
- B. Apply wound paint to above-ground cuts and abrasions.
- C. If trees and shrubs indicated to remain are damaged excessively, as determined by AHJ, Architect or authorities having jurisdiction, remove and replace damaged plants with comparable plants.

### **3.08 DEBRIS**

- A. Remove debris, junk, and trash from site.
- B. Remove logs, rocks and other debris.
- C. Dispose of Debris resulting from clearing and thoroughly clean rights-of-way.
- D. Leave site in clean condition, ready for subsequent work.
- E. Clean up spillage and wind-blown debris from public and private lands.

### **3.09 DISPOSAL**

- A. Debris Disposal: Dispose of all cleared and grubbed materials in a legal manner off site.
- B. Hazardous Materials:
  - 1. Immediately notify the AHJ should hazardous materials or suspected hazardous materials be encountered.
  - 2. Dispose of such materials in accordance with all applicable laws and regulations and as directed by authorities having jurisdiction.
  - 3. Unforeseen conditions will be resolved in accordance with the Conditions of the Contract.
- C. Saleable Materials:
  - 1. Unless otherwise indicated, all felled trees from which merchantable lumber or firewood can be produced shall become the property of the Contractor.
  - 2. Unless otherwise indicated, all metallic debris of salvageable value shall become the property of the Contractor.
  - 3. The Contractor shall remove all saleable materials from the site in a timely manner.
  - 4. Sale of salvaged and merchantable materials shall be done on site only with prior approval of the Owner.
- D. Stockpiling Vegetation: Only if specified or indicated under landscape work, stockpile vegetation for subsequent mulching.
- E. Burial and Burning: Debris shall not be buried or burned on site.

### **3.10 DUST CONTROL**

- A. Refer to requirements of:
  - 1. Section 01 50 00 - Temporary Construction Facilities and Controls.
  - 2. Section 31 22 00 - Grading.
- B. Minimize dust during clearing and grubbing to protect adjoining property and vehicles parked in the vicinity.
- C. Clean-up: Keep public thoroughfares clear of dust and debris by periodic sweeping and washing down, at least daily at the end of working hours.

**END OF SECTION**

## **SECTION 31 22 00 GRADING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Coordinate work of this Section to compliment and coordinate with field conditions and Civil Drawing noted specific referenced requirements. Utilize the most stringent requirements.
- B. Removal of topsoil.
- C. Rough grading and consolidation/compaction the site for site structures and building pads.
  - 1. Preparation for excavation, trenching, backfilling and compacting Work.
- D. Excavation of subsoil, stockpiling for later reuse, and removal of excess from the site.
- E. Preparing of subgrade for walks, pavements and site retaining walls.
- F. Excavating, backfilling and compaction for wet utility lines.
- G. Finish grading.

#### **1.02 RELATED REQUIREMENTS**

- A. Document 00 31 00 - Available Project Information: Subsurface Investigations.
- B. Section 01 40 00 - Quality Requirements.
- C. Section 01 45 33 - Code-Required Special Inspections.
- D. Section 01 70 00 - Execution and Closeout Requirements.
- E. Section 31 10 00 - Site Clearing.
- F. Section 31 23 16 - Excavation.
- G. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.
- H. Section 31 23 23 - Fill: Filling and compaction.
- I. Section 32 13 13 - Site Concrete.
- J. Section 32 90 00 - Planting: Topsoil in beds and pits.

#### **1.03 SUBMITTALS**

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.
  - 1. Accurately record location of all changes in finish elevations and gradients which materially affect drainage.

#### **1.04 QUALITY ASSURANCE**

- A. Regulatory Requirements: For conditions not covered in this Section, refer to applicable provisions of the California Building Code (CBC), Chapter 18A - Soils and Foundations, as amended and adopted by authorities having jurisdiction.
- B. Perform Work in accordance with locally adopted ASTM F588 standards.



## **1.05 PROTECTION**

- A. Dust Control: Comply with requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
- B. Protection:
  - 1. Comply with general requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
  - 2. Provide protection for walks, curbs, drains, and trees and boxing around corners of existing buildings to prevent damage.
  - 3. Keep adjacent roads, streets and drives clear of dirt and debris from earthwork operations.
- C. Underground Utilities:
  - 1. Buried utility lines may exist.
  - 2. If such are encountered, notify AHJ, Architect and Owner and for directions to be followed for preservation, relocation or demolition of utilities.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Topsoil: See Section 31 23 23.
- B. Shoring and Bracing: Provide all materials and services necessary to properly engineer and construct shoring for excavations. Selection of materials and design of shoring, underpinning and bracing of new and existing structures shall be solely the responsibility of the Contractor.
  - 1. Shoring design shall comply with State of California Trenching and Shoring Manual issued by Offices of Structure Construction; 2011.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Verify the absence of standing or ponding water.
- C. Upon discovery of unknown utility or concealed conditions, discontinue affected Work and notify AHJ, Architect and Owner for direction. Unforeseen conditions shall be resolved in accordance with the General Conditions.

### **3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above- and below-grade utilities to remain.
  - 1. Maintain and protect existing utilities remaining which pass through Project area.
- D. Notify utility company to remove and relocate utilities, as required.

- E. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.
- F. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.
- G. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.
- H. Protect plants, lawns, and other features to remain as a portion of final landscaping.

### **3.03 ROUGH GRADING**

- A. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, in excess of 1 inch in size.
  - 1. Coordinate topsoil with Section 10 00 - Site Clearing and Grubbing.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil , unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. See Section 31 23 23 for filling procedures.
- G. All permanent cut or fill slopes shall have a maximum slope of 2:1 (H:V) ratio, horizontal to vertical and shall comply with applicable requirements of the Geotechnical Report and California Building Code (CBC).
- H. Benching Slopes: Horizontally bench existing slopes greater than 5:1 (H:V) to key fill material to slope for firm bearing.
- I. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- J. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.
- K. Grade top perimeter of excavations to prevent surface water from draining into excavation.
  - 1. Provide dewatering of excavations as required to ensure suitable conditions for concrete and backfilling operations.
- L. Uniformly grade areas as shown on Drawings to tolerances specified in this Section..
  - 1. Evenly grade between points where elevations are shown or between points of Work and existing grades.
- M. Slope rough grade away from building perimeter at gradient indicated.
  - 1. Upaved area slope for a distance of 10 feet from the building: Not less than one unit vertical in 20 units horizontal or 5 percent.
    - a. CBC Section 1804A.4.
  - 2. When supported by soil conditions and climate; slope not less than 1:48 or 2 percent in unpaved areas.
    - a. CBC Section 1804A.4, Exception.

- N. Make grade changes gradual. Blend slopes into level areas.

### **3.04 SOIL REMOVAL AND STOCKPILING**

- A. Stockpile topsoil to be re-used on site; remove remainder from site.
  - 1. Topsoil and vegetation layers, root zones, and similar surface materials should be stripped and stockpiled for either reuse in landscape surface areas or removed from the site.
- B. Stockpile subsoil on site for backfill, if soil is appropriate.
  - 1. Stockpile subsoil to depth not exceeding 8 feet.
- C. Remove all lumped subsoil, boulders and rock in excess of 3 inches in greatest dimension.
- D. Stockpile subsoil to be re-used on site; remove remainder from site.
- E. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; cover to protect from erosion.

### **3.05 FINISH GRADING**

- A. Before Finish Grading:
  - 1. Verify building and trench backfilling have been inspected.
  - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
  - 1. Comply with CBC Section 1804A.3.
- C. Where topsoil is to be placed, scarify surface to depth of 6 inches.
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 6 inches.
- E. Place topsoil in areas indicated.
- F. Place topsoil where required to level finish grade.
- G. Place topsoil during dry weather.
- H. Remove roots, weeds, rocks, and foreign material while spreading.
- I. Near plants spread topsoil manually to prevent damage.
- J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- K. Lightly compact placed topsoil.
- L. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

### **3.06 TOLERANCES**

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).
- C. Athletic Field Final Porous Stone base grade: Utilizing laser guided equipment, fine grade to the required tolerances leaving behind no tire tracks or indentations.

- D. Top Surface Under Paving: Plus or minus 0.04 foot (1/2 inch) from required elevation.

### **3.07 REPAIR AND RESTORATION**

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.
- B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.
- C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

### **3.08 FIELD QUALITY CONTROL**

- A. See Section 31 23 23 for compaction density testing.
- B. Field Quality Control:
  - 1. Field inspections and testing shall be performed in accordance with requirements specified in Section 01 40 00 and 01 45 33.
  - 2. Make required quality control submittals in accordance with requirements specified.
- C. Athletic Field: Provide grading plan and final survey.
  - 1. Perform prior to turf installation, a grade verification survey.
  - 2. Final grade verification shall consist of site survey conducted by the surveyor consisting of a 20 ft. x 20 ft. grid.
  - 3. Additional planarity verification shall consist of string line and 10 ft strait edge checks at random over entire area which has been prepared for synthetic turf.
  - 4. Immediately remediate any areas found not to meet specification.
- D. Non-compliance: Should grade elevations, tests of fill or backfill indicate non-compliance with required elevations or density, Contractor shall over-excavate, recompact and retest until specified grade or density is obtained.
  - 1. Costs and Time associated with remedial Work and retesting shall be in accordance with provisions of the General Conditions.
  - 2. Retesting to demonstrate compliance shall be by a testing laboratory acceptable to Owner and shall be at Contractor's expense.

### **3.09 CLEANING**

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

### **3.10 PROTECTION**

- A. Protect completed grading from erosion from weather and traffic.
- B. Over-excavate and recompact areas damaged by construction activities and weather.

## **END OF SECTION**

## **SECTION 31 23 16 EXCAVATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Excavating for footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Trenching for utilities outside the building to on-site existing utilities.
- C. Temporary excavation support and protection systems.

#### **1.02 RELATED REQUIREMENTS**

- A. Document 00 31 00 - Available Project Information: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 01 40 00 - Quality Requirements: Inspection of bearing surfaces.
- C. Section 01 50 00 - Temporary Facilities and Controls: Dewatering excavations and water control.
- D. Section 01 57 13 - Temporary Erosion and Sediment Control (SWPP): Slope protection and erosion control.
- E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.
- F. Section 02 41 00 - Demolition: Shoring and underpinning existing structures.
- G. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.
- H. Section 31 22 00 - Grading: Grading.
- I. Section 31 23 23 - Fill: Fill materials, backfilling, and compacting.
- J. Section 33 41 00 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

#### **1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction.

#### **1.04 REFERENCE STANDARDS**

- A. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Temporary Support and Excavation Protection Plan.

- C. Project Record Documents: Record drawings at project closeout according to 01 70 00 - Execution and Closeout Requirements. Show locations of installed support materials left in place, including referenced locations and depths, on drawings.
- D. Shoring Installer's Qualification Statement.
- E. Field Quality Control Submittals: Document visual inspection of load-bearing excavated surfaces.

#### **1.06 QUALITY ASSURANCE**

- A. Temporary Support and Excavation Protection Plan:
  - 1. Indicate sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property.
  - 2. Include drawings and calculations for bracing and shoring.
  - 3. Bracing and shoring design to meet requirements of OSHA's Excavation Standard, 29 CFR 1926, Subpart P.
- B. Designer Qualifications: For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in California.
- C. Shoring Installer Qualifications: Company specializing in performing the shoring and bracing work of this section with minimum five years of documented experience.

#### **1.07 COORDINATION OF SPECIFICATION REQUIREMENTS**

- A. Coordinate these Specification Section requirements with specifications included on Drawings. Comply with more stringent requirements and with those requirements of authorities having jurisdiction.
- B. Comply in full with the direction (recommendations) given in the Geotechnical Report.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Bedding and Fill to Correct Over-Excavation:
  - 1. See Section 31 23 23 for bedding and corrective fill materials at general excavations.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that survey bench mark and intended elevations for the work are as indicated.
- B. Survey existing adjacent structures and improvements and establish exact elevations at fixed points to act as benchmarks.
  - 1. Resurvey benchmarks during installation of excavation support and protection systems and notify Owner if any changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

- C. Determine the prevailing groundwater level prior to excavation. If the proposed excavation extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by Architect. If the proposed excavation extends more than 1 foot into the prevailing groundwater, control groundwater intrusion with a comprehensive dewatering procedures, or as directed by Geotechnical Engineer.

### **3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

### **3.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION**

- A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.
  - 1. Excavations in stable rock or in less than 5 feet in depth in ground judged as having no cave-in potential do not require excavation support and protection systems.
  - 2. Depending upon excavation depth, time that excavation is open, soil classification, configuration and slope of excavation sidewalls, design and provide an excavation support and protection system that meets the requirements of 29 CFR 1926, Subpart P:
    - a. Sloping and benching systems.
    - b. Support systems, shield systems, and other protective systems.
- B. Shoring Design: Comply with State of California Trenching and Shoring Manual issued by Offices of Structure Construction; 2011.
  - 1. Provide all materials and services necessary to properly engineer and construct shoring for excavations. Selection of materials and design of shoring, underpinning and bracing of new and existing structures shall be solely the responsibility of the Contractor.
- C. Underpin adjacent structures that could be damaged by excavating work, including utilities and pipe chases.
- D. Protect excavations from cave-in and from loose soil and other matter from falling in.
- E. Leave excavation support and protection systems, used as formwork or within 10 feet of existing foundations, permanently in place, unless otherwise noted.
  - 1. Cut off top 4 feet below grade, abandon remainder.
- F. Excavation support and protection systems not required to remain in place may be removed subject to approval of Owner or Owner's Representative.
  - 1. Remove temporary shoring and bracing in a manner to avoid harmful disturbance to underlying soils and damage to buildings, structures, pavements, facilities and utilities.

### 3.04 EXCAVATING

- A. Excavate to accommodate new structures, paving/site structures, construction operations, paving/site structures, and paving/site structures.
  - 1. Excavate to the specified elevations.
  - 2. Excavate to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work.
  - 3. Cut utility trenches wide enough to allow inspection of installed utilities.
  - 4. Hand trim excavations. Remove loose matter.
  - 5. Excavate subsoil from areas to be filled with structural fill, to construct foundations, footings, slabs on grade, paving and to achieve final finish grades.
  - 6. Over-excavate to working elevations for backfilling and compaction operations.
  - 7. Specific Site / Geotechnical requirements:
    - a. Building Footprint:
      - 1) Within the footprint of proposed buildings, remove/over-excavate and recompact the upper 2 feet of soils below existing grade, or 2 feet below bottom of footings/slab-on-grade, whichever is deeper.
      - 2) Extend over-excavation and recompaction a minimum horizontal distance of 5 feet from perimeter edges of proposed buildings.
      - 3) Localized areas of deeper removals/over-excavation may be required depending on the actual conditions encountered pending verification by the geotechnical engineer during grading to confirm suitable bottom.
    - b. Flatwork/Hardscape/Pavement
      - 1) In areas of proposed concrete flatwork or pavement, provide a minimum over-excavation and recompaction of 2 feet below existing grade or 12 inches below proposed subgrade elevation, whichever is deeper.
      - 2) Extend over-excavation and recompaction a minimum horizontal distance of 2 feet from outside hardscape limits.
      - 3) Proof-roll the bottom of the removal with heavy equipment to identify yielding subgrade conditions (for additional removal, if necessary) under the observation of the geotechnical consultant.
    - c. After completion of the removal of existing fill soils and prior to fill placement, scarify the exposed surface to a minimum depth of 8 inches, moisture condition as necessary to near optimum moisture content and recompact using heavy compaction equipment to an unyielding condition.
    - d. Compact all structural fill within the building footprints throughout to at least 90 percent of the ASTM D1557 laboratory maximum density, at or slightly above optimum moisture.
    - e. Compact all fill within the pavement and hardscape area throughout to at least 90 percent of the ASTM D1557 laboratory maximum density, at or slightly above optimum moisture..



8. Where excavations are made to a depth greater than that indicated, such additional depth shall be filled with concrete having the same compressive strength as specified for the footing.
  - a. Correct unauthorized and erroneous excavation at no change in Contract Time or Contract Sum.
  - b. All over-excavations should extend to a depth where the project geologist, engineer or his representative has deemed the exposed soils as being suitable for receiving compacted fill. The materials exposed at the bottom of excavations should be observed by a representative of the geotechnical engineer or geologist from our office prior to the placement of any compacted fill soils to verify that all old fill is removed. Additional removals may be required as a result of observation and/or testing of the exposed subgrade subsequent to the required over-excavation.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored, per CalOSHA requirements for Type C Soil.
  1. Machine slope banks of excavations to minimum 1 to 1 ratio horizontal to vertical or angle of repose, if less, until shored.
    - a. Exception: If authorized in writing by Geotechnical Engineer.
    - b. Slope must comply with local codes, ordinances and requirements of agencies having jurisdiction.
    - c. See Section 00 31 00 - Available Project Information.
- D. Do not interfere with 45 degree influence line of bearing splay of foundations.
  1. Avoid interference at footings by providing additional width, depth, and other provisions.
- E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- F. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

### **3.05 SUBGRADE PREPARATION**

- A. See Section 31 23 23 for subgrade preparation at general excavations.

### **3.06 FILLING AND BACKFILLING**

- A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.
- B. Install underground warning tape at buried utilities according to Sections 33 14 16, 33 31 13, 33 41 00, and 33 42 11.
- C. See Section 31 23 23 for fill, backfill, and compaction requirements at general excavations.
- D. See Section 31 22 00 for rough and final grading and topsoil replacement requirements.

### **3.07 REPAIR**

- A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23 at no additional cost.

### **3.08 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces by Architect and geotechnical consultant before placement of foundations.
- C. Scarification, over excavation and all other excavations will be subject to the approval of the Geotechnical Engineer.

### **3.09 CLEANING**

- A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.
- B. Remove excavated material that is unsuitable for re-use from site.
- C. Remove excess excavated material from site.
  - 1. Geotechnical engineer or other consultant as selected by Owner to test soils prior to export for disposition.

### **3.10 PROTECTION**

- A. Divert surface flow from rains or water discharges from the excavation.
- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- E. Keep excavations free of standing water and completely free of water during concrete placement.

**END OF SECTION**

## **SECTION 31 23 16.13 TRENCHING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Backfilling and compacting for utilities from 5 FEET outside the building to connection point on-site, where indicated on Drawings.

#### **1.02 RELATED REQUIREMENTS**

- A. 00 31 00 - Available Project Information: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 01 41 00 - Regulatory Requirements: Code Compliance.
- C. Section 31 22 00 - Grading: Site grading.
- D. Section 31 23 16 - Excavation: Building and foundation excavating.
- E. Section 31 23 23 - Fill: Backfilling at building and foundations.
- F. Section 33 14 16 - Site Water Distribution Piping: Potable Water Systems.
- G. Section 33 31 13 - Site Sanitary Sewerage Piping: Sewer piping from building to municipal sewer.
- H. Section 33 42 11 - Stormwater Gravity Piping: Storm drainage piping from building to on-site or off-site storm drain system.

#### **1.03 DEFINITIONS**

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

#### **1.04 REFERENCES**

- A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- E. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Comply with the requirements listed in Section 31 23 23 - Fill.

- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

#### **1.06 COORDINATION OF SPECIFICATION REQUIREMENTS**

- A. Coordinate these Specification Section requirements with specifications included on Drawings. Comply with more stringent requirements and with those requirements of the authorities having jurisdiction.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.

### **PART 2 PRODUCTS**

#### **2.01 FILL MATERIALS**

- A. For fill materials see Section 31 23 23 - Fill.
- B. For bed materials see Section 31 23 23 - Fill.
- C. General Fill: Subsoil excavated on-site.
- D. Structural Fill: Subsoil excavated on-site.
  - 1. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- E. Concrete for Fill: Lean concrete.
- F. Granular Fill - Gravel: Pit run washed stone; free of shale, clay, friable material and debris.
  - 1. Graded in accordance with ASTM C136/C136M, within the following limits:
    - a. 3/4 inch sieve: 95 to 100 percent passing.
- G. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
  - 1. Grade in accordance with ASTM D2487 Group Symbol GM.
- H. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
  - 1. Grade in accordance with ASTM D2487 Group Symbol SW.
- I. Topsoil: Topsoil excavated on-site.
  - 1. Select.
  - 2. Graded.
  - 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
  - 4. Acidity range (pH) of 5.5 to 7.5.
  - 5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.

6. Complying with ASTM D2487 Group Symbol OH.

## **2.02 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

### **3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Protect plants, lawns, rock outcroppings, and other features to remain.
- E. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

### **3.03 TRENCHING**

- A. Excavate subsoil required for conduits, storm drain, sanitary sewer, water and gas piping to municipal utilities.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- D. Trenches Parallel to Footings: Do not place the trench below a 1 vertical to 2 horizontal from 9 inches above the bottom edge of the footing and no closer than 18 inches from the face of footing. CBC Section 1809A.14.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Cut trenches wide enough to allow inspection of installed utilities.
- G. Hand trim excavations. Remove loose matter.
  1. Hand trim for bell and spigot pipe joints.
- H. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- I. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume. See Section 31 23 16.26 for removal of larger material.

- J. Remove excavated material that is unsuitable for re-use from site.
- K. Stockpile excavated material to be re-used in area designated in Section 31 22 00.
- L. Remove excess excavated material from site.
- M. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- N. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

#### **3.04 PREPARATION FOR UTILITY PLACEMENT**

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.
- D. Support pipe and conduit during placement and compaction of bedding fill.

#### **3.05 BACKFILLING**

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage installed piping and conduits, or other work.
- D. Systematically fill and compact as as to achieve 90 percent relative compaction without damaging conduit or pipe. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth or as directed by the Geotechnical Report.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
  - 1. Thrust bearing surfaces: Fill with concrete.
  - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 or 95 percent of maximum dry density as applicable for the fill area.
- J. Compaction Density Unless Otherwise Specified or Indicated:
  - 1. Under paving and similar construction: 95 percent of maximum dry density.
  - 2. At other locations: 90 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

### **3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS**

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, and Duct Bank and \_\_\_\_:
  - 1. Bedding: Use Fill Type SP or SW (ASTM D2487) or SM with sand equivalent of 30 or greater per ASTM D2419, 3 inches thick, compacted to 90 percent..
  - 2. Cover with Fill Type SP, SW, SM, GM per ASTM D2487.
  - 3. Fill up to subgrade elevation.
  - 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
  - 5. Gas Piping: As required by the Gas Company.

### **3.07 TOLERANCES**

- A. Top Surface of General Backfilling: Plus or minus 1.2 inch from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1.2 inch from required elevations.

### **3.08 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Control, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.
- C. See Section 31 23 23 for compaction density testing.
- D. Correct unauthorized excavation at no cost to Owner.
- E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").
- F. If tests indicate work does not meet specified requirements, remove work, replace and retest at no additional cost to Owner.
- G. Correct areas over excavated by error in accordance with Section 31 23 23 - Fill.
- H. Frequency of Tests: See Section 31 22 00 - Grading.

### **3.09 CLEANING**

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

### **3.10 PROTECTION OF FINISHED WORK**

- A. Protect finished Work under provisions of Section 01 50 00 - Temporary Construction Facilities and Controls.
- B. Recompact fills subjected to vehicular traffic.

**END OF SECTION**

## **SECTION 31 23 23**

### **FILL**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

##### **1.02 RELATED REQUIREMENTS**

- A. Document 00 31 00 - Available Project Information: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.
- D. Section 31 22 00 - Grading: Site grading.
- E. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

##### **1.03 DEFINITIONS**

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

##### **1.04 REFERENCE STANDARDS**

- A. ASTM D4829 - Standard Test Method for Expansion Index of Soils.
- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- D. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- E. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- F. DTSC-Clean Fill - California Department of Toxic Substances Control - Clean Imported Fill Material.

##### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Soil Samples: 10 pounds sample of each type of fill; submit in air-tight containers to testing laboratory.



1. Submit samples directly to Geotechnical Engineer for testing and analysis copy transmittals to Architect and Owner.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.
- E. Compaction Density Test Reports.
- F. Manufacturer's Instructions.
- G. Manufacturer's Qualification Statement.
- H. Specimen Warranty.
- I. Provide proof that all imported materials conform to the requirements of DTSC-Clean Fill Imported Fill Materials for School Sites by proper documentation for the imported materials.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where agreed to.
  1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  2. Prevent contamination.
  3. Protect stockpiles from erosion and deterioration of materials.

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

### **PART 2 PRODUCTS**

#### **2.01 FILL MATERIALS**

- A. General Fill: Subsoil excavated on-site.
  1. Graded.
  2. Free of lumps larger than 3 inches, rocks larger than 3 inches, and debris.
  3. Complying with ASTM D2487 Group Symbol CL.
- B. Structural Fill: Subsoil excavated on-site.
  1. Graded.

2. Free of organic matter, debris, and oversize particles (e.g., cobbles, rubble, etc. that are larger than 3 inches, rocks larger than 3 inches. Fill shall contain at least fifty percent of material smaller than 1/4 inch in size.
3. Imported fill materials: The soil shall be tested for potential contamination in accordance with DTSC-Clean Fill protocols. Submit to Geotechnical Engineer.
  - a. Import sandy soil shall be free of organics, debris and oversize particles (e.g., cobbles, rubble, rocks, etc. that are greater than 3 inches in the largest dimension).
  - b. Additionally, import soils shall not have any corrosion impacts to buried concrete; and be non-expansive (Expansion Index less than 21 per ASTM D4829).
  - c. Prior to import, geotechnical consultant shall evaluate and test the import soils in order to confirm the quality of the material.
4. On-site soils should only be used as specified in the Soils Report.
5. Complying with ASTM D2487 Group Symbol CL.
- C. Concrete for Fill: As specified in Section 03 30 00; compressive strength of 2500 psi.
  1. Exception: Concrete used under footings and foundations to correct over-excavation shall be same as for footings and foundation.
- D. Granular Fill - Fill Type GM, GW: Coarse aggregate, conforming to Uniform Standard Specifications for Public Works Construction Off-Site Improvements standard.
- E. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
  1. Grade in accordance with ASTM D2487 Group Symbol GP.
- F. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
  1. Grade in accordance with ASTM D2487 Group Symbol SP or SW.
- G. Topsoil: Topsoil excavated on-site.
  1. Unclassified.
    - a. The soil shall be tested for potential contamination in accordance with DTSC-Clean Fill protocols.
  2. Graded.
  3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
  4. Acidity range (pH) of 5.5 to 7.5.
  5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
  6. Complying with ASTM D2487 Group Symbol OH.
  7. Limit decaying matter to 5 percent of total content by volume.
- H. Type F - Subsoil: Reused, free of rocks larger than 3 inch size, and debris.
  1. Existing fill and alluvium or older alluvium may be considered suitable for re-use as compacted fills provided the recommendations of the geotechnical report and observations of the geotechnical engineer are followed.

## **2.02 ACCESSORIES**

- A. Geotextile Fabric: Non-biodegradable, non-woven; Geotex 801 manufactured by Propex Geotextile Systems, geotextile.com.

## **2.03 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.
- E. Comply with EPA/DTSC-Clean Fill requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify structural or other backfill materials to be reused or imported are acceptable to the satisfaction of the Geotechnical Engineer. Approval shall be obtained in advance of re-use or importation onto the site.
  - 1. Test soil for potential contamination in accordance with DTSC-Clean Fill protocols.
  - 2. Provide imported fill materials compatible with on-site soils in addition to being suitable for its intended use with the following criterion, as allowed by the Geotechnical Engineer.
    - a. Predominantly granular in nature.
    - b. Containing no rocks larger than 3 inches maximum dimension.
    - c. Free of organic material (loss on ignition less-than 2 percent).
    - d. Very low expansion potential (with an Expansion Index less than 21).
    - e. Low corrosion impact to the proposed improvements.
- B. Verify that survey bench marks and intended elevations for the Work are as indicated.
- C. Identify required lines, levels, contours, and datum locations.
- D. See Section 31 22 00 for additional requirements.
- E. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- F. Verify structural ability of unsupported walls to support imposed loads by the fill.
- G. Verify areas to be filled are not compromised with surface or ground water.

### **3.02 PREPARATION**

- A. Scarify and proof roll subgrade surface to a depth of 8 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with AWS D1.4/D1.4M Type II or concrete fill and compact to density equal to or greater than requirements for subsequent backfill material.

- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Prior to placement of aggregate base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with ASTM D1557.
- E. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

### **3.03 FILLING**

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
  - 1. Place fill soils compacted in horizontal lifts to a relative compaction of 90 percent or more in general accordance with ASTM D1557.
  - 2. Lift thickness for fill soils will vary depending on the type of compaction equipment used but should generally be placed in horizontal lifts not exceeding 8 inches in loose thickness.
  - 3. Place fill soils at slightly above optimum moisture content as evaluated by ASTM D1557.
  - 4. Avoid damage to wet and dry utility lines when compacting fill and subgrade materials.
- C. Employ a placement method that does not disturb or damage other work.
  - 1. Do not disturb or damage foundation perimeter drainage and foundation waterproofing and protective cover utilities in trenches.
- D. Systematically fill and compact per geotechnical report. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
  - 1. Load-bearing foundation surfaces: Fill with concrete.
  - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 or 95 percent of maximum dry density in subgrade zone.
- J. Compaction Density Unless Otherwise Specified or Indicated:
  - 1. Under paving, slabs-on-grade, and similar construction: 90 percent of maximum dry density.
  - 2. At upper 12 inches beneath vehicular pavements: 95 percent of maximum dry density.
  - 3. At other locations: At least 90 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

- L. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- M. Remove surplus fill and backfill materials from site.

### **3.04 FILL AT SPECIFIC LOCATIONS**

- A. Use general fill unless otherwise specified or indicated.
- B. Structural Fill:
  - 1. Use general fill.
  - 2. Fill up to subgrade elevations.
  - 3. Maximum depth per lift: 6 inches, compacted.
  - 4. Compact to minimum at least 90 percent of maximum dry density.
- C. Under Interior Slabs-On-Grade:
  - 1. Comply with CALGreen Section 4.505.2.1 Capillary Break and {\rs\#1}
  - 2. Use granular fill. Type Class 2 Aggregate base or No. 8 or No. 89, 1/2 inch or larger.
  - 3. Depth: 4 inches deep.
  - 4. Compact to at least 90 percent of maximum dry density.
- D. At Footings:
  - 1. Use general fill.
  - 2. Fill up to subgrade elevation.
  - 3. Compact each lift to at least 90 percent of maximum dry density.
  - 4. Do not backfill against unsupported foundation walls.
  - 5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- E. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
  - 1. Drainage fill and geotextile fabric: Section 33 41 00.
  - 2. Cover drainage fill with general fill.
  - 3. Fill up to subgrade elevation.
  - 4. Compact to at least 90 percent of maximum dry density.
- F. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
  - 1. Bedding: Use general fill.
  - 2. Cover with general fill.
  - 3. Fill up to subgrade elevation.
  - 4. Compact in maximum 8 inch lifts to at least 90 percent of maximum dry density. Compact to at least 95 percent in subgrade zone.
- G. At Planting Areas Other Than Lawns :
  - 1. Use general fill.

2. Fill up to finish grade elevations.
  3. Compact to at least 90 percent of maximum dry density.
  4. See Section 31 22 00 for topsoil placement.
- H. Under Monolithic Paving :
1. Compact subsoil to at least 90 percent of its maximum dry density before placing fill.
  2. Use general fill.
  3. Fill up to subgrade elevation.
  4. Compact to at least 90 percent of maximum dry density; , 95 percent in upper 12 inches.
  5. See Section 32 11 23 for aggregate base course placed over fill.

### **3.05 TOLERANCES**

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

### **3.06 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
  1. Laboratory Tests and Analyses: Where backfill is required to be compacted to a specified density, tests for compliance shall be made in accordance with requirements specified in Section 01 40 00 - Quality Requirements.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.
  1. Field inspections and testing shall be performed and submitted in accordance with requirements specified in Section 01 40 00 - Quality Requirements.
  2. Allow testing service to inspect and approve each subgrade and fill layer before further fill, backfill or construction Work is performed.
  3. Alternate Density Test Method:
    - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D6938, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D1556/D1556M.
    - b. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D6938.
    - c. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of Work, on each different type of material encountered, and at intervals as directed by Architect or Owner's testing and inspection agency.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor") or AASHTO T 180.
- D. Non-compliance: If tests indicate work does not meet specified requirements, remove work, replace and retest.

1. Should tests of fill or backfill indicate non-compliance with required density, Contractor shall over-excavate, recompact and retest until specified density is obtained.
  2. Costs and Time associated with remedial Work and retesting shall be in accordance with provisions of the General Conditions.
  3. Retesting to demonstrate compliance shall be by a testing laboratory acceptable to Owner and shall be at Contractor's expense.
- E. Frequency of Tests:
1. Footing Subgrade Testing:
    - a. For each strata of soil on which footings will be placed, perform at least one in-place density test to verify required design bearing capacities.
    - b. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Geotechnical Engineer.
  2. Paved Areas and Building Slab Subgrade Testing:
    - a. Perform at least one field density test of subgrade for every 2,000 sf of paved area or building slab, but in no case fewer than three tests.
    - b. In each compacted fill layer, perform one field density test for every 2,000 sf of overlaying building slab or paved area, but in no case fewer than three tests.
  3. Foundation Wall Backfill Testing: Perform at least two field density tests at locations and elevations as directed.
- F. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

### **3.07 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

### **END OF SECTION**

## **SECTION 32 11 23 AGGREGATE BASE COURSES**

### **1.01 SECTION INCLUDES**

- A. Aggregate base course.
- B. Paving aggregates.
- C. Soil sterilization.
- D. Aggregate Drainage (Base Stone) Course at synthetic turf.
- E. Aggregate base course at running track.

### **1.02 RELATED REQUIREMENTS**

- A. Section 00 31 00 - Available Project Information: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 31 22 00 - Grading: Preparation of site for base course.
- C. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.
- D. Section 31 23 23 - Fill: Compacted fill under base course.
- E. Section 32 12 16 - Asphalt Paving: Finish and binder asphalt courses.
- F. Section 32 13 13 - Site Concrete: Finish concrete surface course.

### **1.03 REFERENCE STANDARDS**

- A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D2937 - Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
- D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- H. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- I. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb sample of each type of aggregate; submit in air-tight containers to testing laboratory.



- C. Materials Sources: Submit name of imported materials source.
- D. Certificates of Conformance: Aggregate and sterilant materials.
- E. Installer's Qualification Statement.
- F. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- G. Compaction Density Test Reports.

#### **1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: Where reference is made to Standard Specifications, the following shall apply.
  - 1. Perform off-site Work in public rights-of-way in accordance with requirements of authorities having jurisdiction, including SSPWC (Greenbook). For conditions not indicated otherwise on Contract Drawings, conform to Standard Details adopted by authorities having jurisdiction.
  - 2. Perform on-site Work as indicated and referenced on Contract Drawings and as specified herein.
- B. The quantity of volatile organic compounds (VOC) used in weed killer, tack coat, primer and other materials shall not exceed limits permitted under current regulations of:
  - 1. Local Air Quality Management District (AQMD).
- C. Source Quality Control: Obtain materials from one source throughout.
- D. Synthetic Surfacing:
  - 1. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
    - a. Additional Requirements:
      - 1) Maintain a current California Class A Engineering Contractor's License.
      - 2) Completed 10 similar base systems in California during the past 5 years.
      - 3) Submit proof of qualifications prior to award of bid.
  - 2. Perform Work in accordance with Standard Specifications for Public Works Construction and Synthetic Surface Manufacturer's Warranty Requirements.
    - a. Synthetic Surface Warranty Requirements:
      - 1) Compaction of sub-grade: minimum 95% Modified Proctor density.
      - 2) Planarity of sub-grade: tolerance of one inch in ten feet.
      - 3) Compaction of aggregate base: 92%-95% Modified Proctor density.
      - 4) Surface tolerance of aggregate base: not to exceed 1/4 inch over 10 feet and 1/2 inch from design grade.
  - 3. Certification of Field Base Installation:
    - a. The Synthetic Turf Surfacing Contractor shall perform an inspection of the synthetic base underlayment and base and submit written certification of acceptance of the base prior to the installation of the synthetic turf system.
    - b. Summary of certification shall include, but not be limited to:

- 1) Acceptance of the base construction "finish surfaces" as totally suitable for the application of work specified under this section.
  - 2) Verification and certification of the infiltration and permeability rates of the permeable aggregate as applying to the warranty.
  - c. All discrepancies between the required materials, application and tolerance requirements noted by the turf installer shall be brought immediately to the attention of the Contractor and the Architect.
    - 1) Failure of the turf installer to immediately inform the Contractor and Architect of any prior work that does not meet the required specifications will result in the turf installer being required to perform all work needed to bring the base to acceptable condition.
- E. Running Track:
1. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
  2. Additional Requirements:
    - a. Maintain a current California Class A Engineering Contractor's License.
    - b. Completed 10 similar base systems in California during the past 5 years.
    - c. Submit proof of qualifications prior to award of bid.
  3. Perform Work in accordance with Standard Specifications for Public Works Construction and Synthetic Surface Manufacturer's Warranty Requirements.
    - a. Synthetic Surface Warranty Requirements:
      - 1) Compaction of sub-grade: minimum 95% Modified Proctor density.
      - 2) Planarity of sub-grade: tolerance of one inch in ten feet.
      - 3) Compaction of aggregate base: 92%-95% Modified Proctor density.
      - 4) Surface tolerance of aggregate base: not to exceed 1/4 inch over 10 feet and 1/2 inch from design grade.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate where directed by Owner.
- C. Aggregate Storage, General:
  1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  2. Prevent contamination.
  3. Protect stockpiles from erosion and deterioration of materials.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Sub-Base Material: Existing or imported materials as recommended in geotechnical report. Refer to Document 00 31 00 - Available Project Information.

B. Aggregate Type Class II: Coarse or crushed aggregate, conforming to Municipality, ASTM F588 Section 200-2.2.

1. Running Track: Non-Permeable Class II base material meeting ASTM C136/C136M.
2. Synthetic Turf: Permeable aggregate base material meeting the following sieve analysis per SSPWC (Greenbook) or CalTrans Test 202.
  - a. See section 32 18 13 - Synthetic Grass Surfacing to confirm permeability performance with surfacing provider.

Gradation : Cumulative Percent Passing (Suggested prior to permeability testing or as required by syntehtic turf installer/manufacturer.)

<u>Screen Inches</u>	<u>mm/μm</u>	<u>Course 75%</u>	<u>Fine 25%</u>	<u>Permeable Blend</u>	<u>Permeable Blend Target Gradation</u>
1 inch	25.00 mm	100		100	100
3/4 inch	19.0 mm	99		100	90-100
1/2 inch	12.5 mm	70		95	xxx
3/8 inch	9.5 mm	45	100	73	40-100
#4	4.75 mm		98	38	25-40
#8	2.36 mm		78	29	18-33
#16	1.18 mm		57	21	xxx
#30	600 μm		34	15	5.0-15
#50	300 μm		17	10	0-7
#100	150 μm		6	8	xxx
#200	75 μm		3	4	0-3

- b. In addition to the above gradation the submitted material shall be crushed and angular in composition. Material with rounded composition shall be rejected.
  - c. Sand used in this material shall be washed clean and free of soil based materials.
- C. Coarse Aggregate: Pit run washed stone; free of shale, clay, friable material and debris.
  1. Graded in accordance with ASTM D2487 Group Symbol GW.
- D. Herbicide: Comply with all applicable environmental protection and hazardous materials laws and regulations .
  1. Comply with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant.
  2. Comply with the "Healthy Schools Act" as amended in 2014.
  3. Obtain product approval from Owner, prior to purchase and use.
  4. Sterilant: Commercial grade for commercial application.
    - a. Selected as appropriate for the environment in which is it to be placed.
  5. Contractor shall be licensed with the State of California to apply sterilant.
  6. Sterilant: Commercial grade for commercial application.

7. Payment for soil sterilization: Include full compensation for application and all materials and incidental work required.
8. Application Rate: Follow manufacturer recommendations.
9. Acceptable Manufacturers:
  - a. Dow AgroSciences; Spike 80DF: [www.dowagro.com](http://www.dowagro.com).
  - b. Pro-Serve Inc.; Bare-Spot Monobor-Chlorate: [www.pro-serveinc.com](http://www.pro-serveinc.com).
  - c. Casoron 50W by Uniroyal Chemical Co., Inc.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Geotextile Fabric: Non-biodegradable, non-woven, placed under base;.

## **2.02 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance shall be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

## **2.03 EXAMINATION**

- A. Establishment of Grades
  1. Set grade stakes per Section 01 70 00 - Execution and Closeout Requirements.
  2. All work shall conform to the lines, elevations, and grades shown on the Drawings.
    - a. Use three consecutive points set on the same slope together so that any variation from a straight grade can be detected.
    - b. Report any such variation to the Architect. Contractor shall be responsible for any error in the grade of the finished work.
  3. Grade or location stakes lost or disturbed, shall be reset by the Surveyor at no additional expense to Owner.
  4. Areas having drainage gradients of 2 percent or more, provide elevation stakes, set with instrument, at grid intervals of 25 feet.
    - a. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes.
    - b. Grade stakes must be set at all grade breaks, grade changes, etc.
  5. Areas having drainage gradients of less than 2 percent; provide elevation stakes, set with instrument, at 10 foot intervals.
    - a. Grade stakes must be set at all grade breaks, grade changes, etc.
- B. Verify that survey bench marks and intended elevations for the work are as indicated.
- C. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

## 2.04 PREPARATION

- A. Stockpiling:
  - 1. Clear and level storage sites prior to stockpiling of material.
  - 2. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated.
  - 3. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Owner Representative to prevent segregation.
  - 4. Materials obtained from different sources shall be stockpiled separately.
- B. Soil Sterilant:
  - 1. Sterilize soil areas to receive paving.
  - 2. Apply soil sterilant in accordance with manufacturer's instructions and applicable environmental regulations.
  - 3. Take care to confine application to the areas to be paved. Sterilant shall not be applied within 2 feet of planting areas.
- C. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- D. Do not place aggregate on soft, muddy, or frozen surfaces.
- E. Place and compact aggregate base material in accordance with SSPWC (Greenbook), Subsection 301-2. Place aggregate base below curbs and gutters and paving also, compacted to 95 percent at vehicular traffic and 90 percent at pedestrian-only traffic.
- F. Application of Base Course:
  - 1. After preparing the subgrade, Avoid all vehicular or machine traffic on the subgrade.
    - a. Should it be necessary to haul over the prepared subgrade, drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface.
    - b. Rake and hand tamp all cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations.
    - c. Equip with pneumatic tires all equipment used for transporting materials over the prepared subgrade.
  - 2. Do not permit continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section. Protect the prepared subgrade from all traffic.
  - 3. Maintain the surface in its finished condition until the succeeding layer is placed.
- G. Under Bituminous Concrete Paving:
  - 1. It is required that areas of exterior asphalt pavement be underlain by a layer of aggregate base material which meets the requirements, Thickness of base layer is as shown on the Drawings and varies per the Usage Type area.
    - a. It is required that the upper 12 inches of soils below asphalt pavement base material be over-excavated and consist predominantly of satisfactory soil materials and/or approved imported fill.
      - 1) Engineered Fill: See Section 31 23 23 - Fill.

- b. It is required that the exposed bottom surface soils, below overexcavation, be scarified to the recommended depth of 8 inches, moisture conditioned to achieve optimum moisture content, but not higher than 2 percent above optimum, and then re-compacted to a minimum 90 percent relative compaction before any fill materials are placed.
- 2. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site.
  - a. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual subgrade preparation will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.
- 3. Provide grade stakes and elevations by a California Licensed Surveyor (LS) for the Geotechnical Engineer.
  - a. Verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement structural sections, have been achieved prior to re-compaction.
- 4. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.
- 5. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required at no additional cost. Subject to the approval of the Architect.
- 6. Remove excess material from the site to a legal disposal area.
- H. Under Portland Cement Concrete Paving:
  - 1. Compact to 95 percent of maximum dry density and 90 percent at pedestrian-only traffic.
- I. Level and contour surfaces to elevations and gradients indicated.
- J. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- K. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- L. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- M. Running Track: Final aggregate base grade shall be achieved utilizing laser controlled equipment.
  - 1. NO OTHER MEANS OF ATTAINING FINAL GRADE SHALL BE ALLOWED.
  - 2. Surface stability shall be such that a laser controlled motor grader or tractor and towed laser controlled gannon can fine grade to the required tolerances leaving behind no tire tracks or indentations.
    - a. If necessary, in order to attain surface stability, Contractor shall add small quantities of fine aggregate as appropriate to assist in attainment of stability.
    - b. Contractor shall be responsible for delivery of the graded aggregate base to the satisfaction of the AHJ, Architect, and Architect's consultants at Contractor's expense.

- c. The Architect has the final word on all matters relating to compliance with the plans and specifications.
- N. Apply herbicide to finished surface.

## **2.05 TOLERANCES**

- A. Subgrade Tolerances:
  - 1. Subgrade for Pavement: Do not vary more than 0.02 ft..
  - 2. Subgrade for Subbase or Base Material: Do not vary more than 0.04 ft..
  - 3. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.
- B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation From Design Elevation: Within 1/2 inch.

## **2.06 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing shall be performed on compacted aggregate base course in accordance with ASTM D1556 or ASTM D6938.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Proof roll compacted aggregate at surfaces that are under slabs-on-grade and paving.
- F. Running Track:
  - 1. Independent Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing. This agency is to test the following:
    - a. Compaction testing of sub-grade, finish grade and each lift of synthetic surface base, measured at a minimum of 8 locations randomly spaced across the surface of each field.
    - b. Test aggregate base material upon delivery to the job site to verify that material meets the specified gradation & permeability requirements. Every 10th load to be tested on site.
    - c. Test compaction of soils and base materials in place according to ASTM D1556/D1556M, ASTM D1557, ASTM D2167, ASTM D6938, and ASTM D2937, as applicable.
  - 2. Planarity Tolerrance:
    - a. Prior to synthetic surface installation, perform a grade verification survey. Final grade verification shall consist of site survey conducted by an Owner provided Land Survey Engineer.

- 1) Verify the elevation of the the perimeter nailer
  - 2) Survey is to consist of a 30 x 30 foot grid.
    - (a) Additional planarity verification shall consist of string line and 10 ft straight edge checks in between grid points, over entire area which has been prepared for synthetic surface.
  - 3) Immediately remediate any areas found not to meet specification.
  - 4) Architect has the final word on all matters relating to compliance with the plans and specifications.
3. When test indicate materials and work do not meet specified requirements, remove, replace and retest.
  4. Independent testing agency results verifying compliance with compaction & permeability requirements shall be supplied to the synthetic surface contractor prior to the commencement of synthetic surface installation.
    - a. The synthetic surface Contractor is to not proceed with the installation of the synthetic surfacing system until acceptable compaction, permeability, and planarity test results have been achieved.

## **2.07 CLEANING**

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

## **END OF SECTION**



## **SECTION 32 12 16 ASPHALT PAVING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Aggregate base course.
- B. Single course bituminous concrete paving.
- C. Double course bituminous concrete paving.
- D. Surface sealer.
- E. This section compliments and shall be coordinated with Civil Drawing specifications / requirements. The most stringent requirements shall be utilized.
- F. Asphaltic concrete paving for vehicular traffic and curbs, including necessary patching and repair of damaged new and existing paving.
- G. Patching and repair of existing asphaltic concrete paving for previous damage, for underground utility work and where damaged by new construction.
  - 1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.
  - 2. Areas heaved by tree roots, cracked areas, holes, and trenches.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 02 41 00 - Demolition: Selective demolition, site demolition, structure removal.

#### **1.03 REFERENCE STANDARDS**

- A. AASHTO T 283 - Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage.
- B. AASHTO T 324 - Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures.
- C. AI MS-2 - Asphalt Mix Design Methods.
- D. AI MS-19 - Basic Asphalt Emulsion Manual.
- E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
- F. ASTM C117 - Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing.
- G. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- H. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
- I. ASTM D6140 - Standard Test Method to Determine Asphalt Retention of Paving Fabrics Used in Asphalt Paving for Full-Width Applications.
- J. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

- K. ASTM D5035 - Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).
- L. ASTM D5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
- M. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- N. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
- O. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

#### **1.04 SUBMITTALS**

- A. Materials List: List source and quality standard for all asphaltic concrete materials.
- B. Mix Design:
  - 1. Formulate a job-mix formula using the Hveem method in accordance with SSPWC (Greenbook) Section 203-6.2 and submit for approval.
  - 2. Submit designs for asphaltic concrete prepared by a materials laboratory under direct supervision of a Civil Engineer licensed in the State of California or a standard mix design proven in actual performance.
  - 3. Resultant Mixture: Hveem properties conforming to SSPWC (Greenbook) Section 203-6.4.4.
- C. Certifications:
  - 1. Weighmaster's Certificates or certified delivery tickets for each truckload of bituminous material delivered to site.
  - 2. Certificates of Conformance: Asphalt, aggregate and sterilant materials.
    - a. 20 days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, submit certificates and test results of compliance of such materials with these specifications.
    - b. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
    - c. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
    - d. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.
- D. Samples:
  - 1. Prior to the delivery of specified aggregate to the site, submit samples of the material for the Inspector's acceptance in accordance with SSPWC (Greenbook) Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.
  - 2. Provide aggregate base gradation and quality certifications, dated within 30 days of submittal.

## **1.05 QUALITY ASSURANCE**

- A. Perform Work in accordance with locally adopted {\rs\#1}.
- B. Mixing Plant: Conform to Locally adopted SSPWC (Greenbook).
  - 1. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.
  - 2. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.
- C. Testing and analysis of granular base material and asphaltic concrete paving mix shall be performed under provisions of Division 01.
- D. Obtain materials from same source throughout.

## **1.06 FIELD CONDITIONS**

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen; or when rain is imminent.
  - 1. Tack Coats: Minimum surface temperature of 60 deg F.
  - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with applicable code for paving work on public property.
- B. Where reference is made to SSPWC (Greenbook), the following shall apply.
  - 1. For conditions not indicated otherwise on Contract Drawings, conform to Standard Details adopted by authorities having jurisdiction, including Standard Details for Public Works Construction, as amended and adopted by those authorities.
  - 2. Perform on-site Work as indicated and referenced on Contract Drawings and as specified herein.
- C. The quantity of volatile organic compounds (VOC) used in weed killer, seal coat, tack coat, primer, and other materials shall not exceed limits permitted under current regulations of local Air Quality Management District (AQMD).

### **2.02 MATERIALS**

- A. General: Aggregate base, prime coat paint binder, bituminous surface course and other materials shall be as noted on the Contract Drawings and shall comply with requirements of authorities having jurisdiction.
- B. Asphalt Cement: ASTM D 946.

- C. Asphalt Concrete Materials: SSPWC (Greenbook), Subsection 203-6.
- D. Aggregate for Base Course: See Section 32 11 23 - Aggregate Base Course.
- E. Aggregate for Binder Course : Angular crushed washed stone; free of shale, clay, friable material and debris.
  - 1. Graded in accordance with ASTM D2487 Group Symbol GW.
- F. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- G. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.
- H. Geotextile Fabric: Non-biodegradable, non-woven Petromat Enviro manufactured by Propex Operating Company, LLC.
  - 1. Geotextile Construction: Needle-punched nonwoven geotextile composed of 100% polypropylene or polypropylene / recycled polyester blend, staple fiber and heat calendered on one side.
- I. Crack Filler:
  - 1. Cracks less than 1/2 inch in width: GuardTop Crackfiller or equal.
  - 2. Cracks 1/2 inch or greater in width: #4 Sheet mix asphalt.
- J. Primer: In accordance with locally adopted {\rs\#1}.
- K. Tack Coat: Homogeneous, medium curing, liquid asphalt.
- L. Seal Coat: AI MS-19, slurry type.
  - 1. Asphalt Emulsion, [www.aema.org](http://www.aema.org), SS1-h, per SSPWC (Greenbook) Section 203-9.
  - 2. Acceptable Manufacturers:
    - a. Blue Diamond Asphalt; Satin Seal: [www.bluediamondasphalt.com](http://www.bluediamondasphalt.com).
    - b. Diversified Asphalt Product; Over Kote: [www.diversifiedasphalt.com](http://www.diversifiedasphalt.com).
    - c. Gold Star Asphalt Products: [goldstarsphalt.com](http://goldstarsphalt.com)
    - d. SealMaster Pavement Products & Equipment; MasterSeal: [sealmaster.net](http://sealmaster.net).
    - e. Vulcan Materials Company; GuardTop: [www.vulcanmaterials.com](http://www.vulcanmaterials.com).
    - f. Western Colloid Products; Park Top: [www.westerncolloid.com](http://www.westerncolloid.com).
    - g. Substitutions: See Section 01 60 00 - Product Requirements.

### 2.03 GEOTEXTILE INTERLAYER FOR BITUMINOUS PAVEMENT OVERLAYS

- A. Geotextile Fabric: Non-biodegradable, non-woven manufactured by Propex Operating Company, LLC., or equal.
- B. The geotextile construction shall be a needle-punched nonwoven geotextile composed of 100% polypropylene or polypropylene / recycled polyester blend, staple fiber and heat calendered on one side.
- C. Geotextile Property Values:

Mass Per Unit Area (1) ASTM D5261	153 (4.5) g/m2 (oz/yd2)
Asphalt Retention (4) ASTM D6140	0.9 (0.20) l/m2 (gal/yd2)

Grab Tensile Strength (2) (MD, CMD, 45 bias) ASTM D4632/D4632M	400 (90)N (lbs)
Grab Elongation (2) (MD, CMD, 45 bias) ASTM D4632/D4632M	> 25 Percent
Strip Tensile Strength (1) (MD, CMD, 45 bias) ASTM D5035	200 (45) N (lbs)
Strip Elongation (1) (MD, CMD, 45 bias) ASTM D5035	> 25 Percent
Asphalt Saturated Grab Tensile Strength (4) (MD, CMD, 45 bias) ASTM D6140, ASTM D4632/D4632M	1023 (230) N (lbs)
Asphalt Saturated Grab Elongation (4) (MD, CMD, 45 bias) ASTM D6140, ASTM D4632/D4632M	> 25 Percent
Thickness (1) ASTM D5199	0.89 (35) mm (mils)
Asphalt Saturated Thickness (4) ASTM D6140, ASTM D5199	1.78 (70) mm (mils)
Melting Point (2) ASTM A276/A276M	160 (320) Degrees C (F)
Solar Reflectance Temperature Reduction, Measured	10 (50) Degrees C (F)
Trapezoidal Tear Strength (2) ASTM D4533/D4533M	< 45 lbs
Asphalt Saturated Trapezoidal Tear Strength (3), ASTM D6140, ASTM D4533/D4533M	< 25 lbs
Milled Enviro RAP Particle Size Distribution (5)	ASTM C117 100 % passing 1.0" ASTM C136/C136M 95% passing 0.75"
Dry Tensile Strength (6), AASHTO T 283: Recycled Pavement Enhancement with 30% Enviro RAP	psi
TSR – Tensile Strength Ratio, AASHTO T 283	> 200 %
Maximum Rut Depth at 20,000 passes (6) AASHTO T 324	> 0.9 mm
Asphalt Stripping at 20,000 passes (6) AASHTO T 324	<2.9
Flexibility Index with Enviro RAP (6), I-FIT6	None >4.5

*(1) Minimum Average Roll Value (MARV) values shown represent weaker principal direction.*

- (2) Typical (Average) values shown represent weaker principal direction.*
- (3) Maximum Test Value (MaxTV) per ASTM D8102 performed annually by third party testing.*
- (4) Minimum Test Value (MinTV) per ASTM D8102 performed annually by third party testing.*
- (5) Field evaluation and testing by NCAT (National Center for Asphalt Technology) or an independent third party approved by project engineer.*
- (6) I-FIT - Illinois Flexibility Index Test*

## **2.04 ASPHALT PAVING MIXES AND MIX DESIGN**

- A. Asphalt Surfacing Materials: Provide asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant.
- B. Use dry material to avoid foaming. Mix uniformly.
- C. Base Course: 4.5 to 5.8 percent of asphalt cement by weight in mixture in accordance with SSPWC (Greenbook) Section 203-6.4.4, Type B.
- D. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
  - 1. CSS-1 h and conform to the requirements of SSPWC (Greenbook), Section 203-3 Emulsified Asphalt.
- E. Parking Lot Wearing Course: 4.6 to 6.0 percent of asphalt cement by weight in mixture in accordance with {\rs\#1} Section 203-6.4.3, Type C2.
  - 1. Provide at least two courses of asphalt when Type C2 asphalt pavement is greater than 3 inches.
  - 2. Surface Course Minimum Thickness: 1 inch and a maximum of 2 inches.
- F. Submit proposed mix design of each class of mix for review prior to beginning of work.

## **2.05 SOURCE QUALITY CONTROL**

- A. Test mix design and samples in accordance with AI MS-2.
- B. Submit asphaltic concrete mix design proposed by the Contractor to the Engineer for review.
- C. Proposed mix to be tested for conformance with the specifications, including grading, asphalt content and stability.

## **2.06 ACCESSORIES**

- A. Headers and Stakes:
  - 1. 2 x 6 inch nominal Redwood, Construction Heart Grade, or preservative treated Douglas Fir (PTDF), except at curves provide laminated 1 x 6 inch nominal PTDF, unless indicated otherwise on Drawings
  - 2. Stakes: 2 x 4 x 18 inch long Redwood, or 2 x 3 x 18 inch long PTDF; at 48 inch on center maximum.
  - 3. Nails: Common, use hot dipped galvanized only, 12d minimum.

- B. Pavement Reinforcing Fabric: Non-woven polypropylene fabric conforming to SSPWC (Greenbook), Subsection 213-1.
  - 1. Basis of Design Product: Petromat as manufactured by Propex Fabrics inc.; [www.geotextile.com](http://www.geotextile.com), or approved equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that compacted subgrade and granular base is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Fine grading, checking, shaping, and compacting of subgrade shall be complete before start of asphaltic concrete Work.
- D. Soil Sterilant: Sterilize soil areas to receive asphaltic concrete paving. Apply soil sterilant in accordance with manufacturer's instructions and applicable environmental regulations. Take care to confine application to the areas to be paved.
- E. Curbs and Gutters: Gutters shall be in place and cured prior to start of asphaltic concrete Work. Provide lumber ramping at all locations where rolling equipment or vehicles cross new concrete paving, curbs and gutters.
- F. Headers: Place headers with tops flush with finish asphaltic concrete surfaces. Back headers with stakes.
  - 1. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.
  - 2. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.
  - 3. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.
  - 4. Remove existing headers where new surfacing is installed adjacent to existing surfacing.
  - 5. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.
  - 6. Provide additional stakes and anchorage as required to fasten headers in place
- G. Do not asphalt concrete on any surface, which contains ponded water or excessive moisture in the opinion of the Architect or consulting engineer.
  - 1. If paving operations are in progress and rain or fog forces a shut down, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore.
  - 2. Provide canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing.

### **3.02 PAVEMENT REPAIR REMOVAL**

- A. Remove bituminous and concrete pavement in accordance with applicable provisions of SSPWC (Greenbook) Section 300 - Earthwork.
- B. Pavement Heaved By Roots:
  - 1. Remove pavement to limits of distortion and expose roots.
  - 2. Trim roots to provide at least 12 inch clearance to pavement.
- C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.
- D. Remove raveled and depressed bituminous pavement to limits indicated or required.
- E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.
- F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

### **3.03 EXCAVATING, BACKFILLING AND COMPACTING FOR REPAIR**

- A. Conform to requirements in Section 31 23 16.13 - Trenching, as required.
- B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with a required material. Install and compact fill materials in accordance with the requirements of related Specification sections.

### **3.04 HEADERS**

- A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.
- B. Install headers so the bottom surface has continuous bearing on solid grade.
  - 1. Where excavation for headers is undercut, thoroughly tamp soil under the header.
  - 2. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.
- C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inches.
  - 1. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers.
  - 2. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header.
  - 3. Provide a minimum of two 12d galvanized common nails through each stake.
- D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.
- E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.
- F. Provide additional stakes and devices as required to fasten headers.

### **3.05 RESURFACING**

- A. Holes and Trenches:



1. Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing.
  2. Resurface flush with existing adjoining pavement installing the same type of materials and section provided in existing improvements.
- B. Other Areas:
1. Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement.
  2. Resurface by following the original grades and installing the same type of materials provided in existing improvements.
- C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

### **3.06 AGGREGATE BASE COURSE**

- A. Place and compact aggregate base course.
- B. Unless otherwise indicated, base course shall be crushed aggregate base, fine grade, 3 inches thick or equal to thickness of the existing base, whichever is greater.
- C. Inspector will examine the base before the paving has begun. Correct any deficiencies before the paving is started.
- D. Wherever asphaltic pavement does not terminate against a curb, gutter, or another pavement, provide and install a redwood or pressure treated Douglas fir header at the line of termination.

### **3.07 PREPARATION - PRIMER**

- A. Apply primer in accordance with manufacturer's instructions.
- B. Apply primer on aggregate base or subbase at uniform rate of 0.25 gal/sq yd.
- C. Apply primer to contact surfaces of curbs, gutters.
- D. Use clean sand to blot excess primer.

### **3.08 PREPARATION - TACK COAT**

- A. Apply tack coat in accordance with SSPWC (Greenbook) Section 302-5.4.
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.10 gal/sq yd.
- C. Apply tack coat to contact surfaces of curbs, gutters and previously placed or existing paving.
- D. Joining Pavement: Expose, cut and clean edges of existing pavement to straight, vertical surfaces for full depth of existing pavement.
  1. Paint edge with asphalt emulsion before placing new asphaltic concrete.
  2. Joints in New Paving: In accordance with SSPWC (Greenbook).

### **3.09 PLACING ASPHALT PAVEMENT - SINGLE COURSE**

- A. Install Work in accordance with {\rs\#1} Subsection 302-5.

- B. Asphalt concrete of the class indicated in Part 2 shall be laid in courses conforming to SSPWC (Greenbook) Table 302-5.5(A), unless otherwise stated herein.
- C. Place asphalt within 24 hours of applying primer or tack coat.
- D. Place thickness as indicated on Civil Drawings to minimum 1 inch compacted thickness.
  - 1. Asphalt concrete work shall include full depth patching and variable thick asphalt concrete transition areas.
  - 2. Provide daily the Inspector, with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work.
  - 3. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
- E. Install gutter drainage grilles and frames and manhole frames in correct position and elevation.
- F. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position.
  - 1. Compact (roll) asphaltic concrete in accordance with SSPWC (Greenbook), Subsection 302-5.6, using machine rollers.
    - a. Compaction by vehicular traffic is prohibited.
    - b. Compact areas inaccessible to rolling equipment with machine-powered tamper.
- G. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

### **3.10 PLACING ASPHALT PAVEMENT - DOUBLE COURSE**

- A. Provide at least two courses of asphalt when Type D2 asphalt pavement is greater than 1-1/2 inches. The surface course shall be a minimum thickness of 1 inch and a maximum of 1-1/2 inches.
- B. Provide at least two courses of asphalt when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of 1 inch and a maximum of 2 inches.
- C. Install Work in accordance with SSPWC (Greenbook) Subsection 302-5.
- D. Place asphalt binder course within 24 hours of applying primer or tack coat.
- E. Place binder course to thickness as indicated on Civil Drawings, minimum 1 inch compacted thickness.
- F. Place asphalt wearing course within two hours of placing and compacting binder course.
- G. Place wearing course to thickness as indicated on Civil Drawings, minimum 1 inch compacted thickness.
- H. Install gutter drainage grilles and frames and manhole frames in correct position and elevation.
- I. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position.
  - 1. Compact (roll) asphaltic concrete in accordance with SSPWC (Greenbook), Subsection 302-5.6, using machine rollers.
    - a. Compaction by vehicular traffic is prohibited.

- b. Compact areas inaccessible to rolling equipment with machine-powered tamper.
- J. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### **3.11 SEAL COAT**

- A. Apply seal coat after surface course application, in accordance with manufacturer's recommendations.
- B. Apply seal coat to surface course and asphalt curbs in accordance with {\rs\#1}, Subsection 302-8.2.
- C. Add water to specified seal coat material. When air temperatures of 90 degrees F or more are encountered during application, consult manufacturer for recommendations.
- D. If pavement surface exhibits imperfections of roller marks, rock pockets, ridges or depressions as determined by the Architectt, the addition of sand aggregate to seal coat, and amounts thereof, shall be as recommended by the manufacturer.
- E. A second application shall be made after first coat has dried to the touch. When sand is added to the first seal coat, two additional coats without extra sand shall be applied.
- F. Allow seal coat to dry before permitting traffic or striping.

### **3.12 PAVEMENT REPAIR AND PAVING**

- A. Preparation of existing pavement: Where indicated, remove loose asphaltic concrete, cleanout "pot holes" and cracks, remove dirt, oil and other foreign materials.
- B. Repair holes with full paving section as specified. Repair "alligatoring" with asphalt "skin-patch". Fill all cracks larger than 1/4 inch wide with asphalt emulsion slurry.
- C. Repair of Existing Surfacing:
  - 1. Fill cracks 1/2 inch wide and less with RS-1 emulsion and silica sand or other required material.
  - 2. Cracks larger than 1/2 inch wide shall be filled with Type C2 Asphalt Concrete as specified.
    - a. Cracks shall be filled to the level of adjacent surfacing.
  - 3. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt.
    - a. Install material, strike off the emulsified asphalt with a straightedge flush with adjoining surfacing.
    - b. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.
- D. Tack Coat: Apply asphalt oil AR-4000 or AR-8000, as required for jobsite condition, at metered application rate of no less than a range from 0.2 to 0.3 gallons per square yard of fabric or as directed by manufacturer and to provide 100 percent fabric saturation and ample bonding for paving section.
- E. Fabric Reinforcement: Place fabric smooth side up in tack coat with 2 to 4 inch overlap. Hand-broom to remove wrinkles. Apply addition tack coat to joints and between overlapped fabric layers.

- F. Overlay Asphalt: Place single course asphalt, 1-1/2 inch compacted thickness, in conformance with specified standards in this section.

### **3.13 TOLERANCES**

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.

### **3.14 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.
- B. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.
  - 1. Flood test entire area in presence of the Project Inspector.
  - 2. Test entire area to verify it is free of standing water or puddles.
- C. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in SSPWC (Greenbook), Section 302-5.6.2.
  - 1. When the test results of the field cores are less than 95% Relative Compaction, remove a 1 foot wide section on each side of the longitudinal joint.
  - 2. Replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.
- D. Test: Flood test all paving to demonstrate positive drainage.
  - 1. Before acceptance, water test all pavements to ensure proper drainage as directed by the Inspector.
  - 2. Flooding Method: By water tank truck.
  - 3. Fill depressions where the water ponds to a depth of more than 1/8 inch; or the slope corrected to provide proper drainage.
  - 4. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible.
  - 5. No standing water shall remain 1-hour after test.

### **3.15 PROTECTION**

- A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.
  - 1. After final rolling, prohibit all traffic on asphaltic concrete until mix has fully cooled and set. Minimum time, in all cases shall be 6 hours.

### **3.16 CLEANING**

- A. After completion of paving operations, clean all existing and new improvements that have been soiled, especially by oil tracking from asphalt tanks or placement in general.

- B. For Substantial Completion review, broom clean and wash paving with hoses. Clean residue from landscaping installation.

**END OF SECTION**

## **SECTION 32 13 13 SITE CONCRETE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Concrete area paving, sidewalks, stair steps, integral curbs, gutters, parking areas, cast-in-place walls, and general site applications.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 07 92 00 - Joint Sealants: Sealing joints.
- C. Section 31 22 00 - Grading: Preparation of site for paving.
- D. Section 31 23 23 - Fill: Compacted subbase for paving.
- E. Section 32 11 23 - Aggregate Base Courses: Gravel base course.
- F. Section 32 17 13 - Concrete Wheel Stops: Precast concrete parking bumpers.
- G. Section 32 17 23 - Pavement Markings.
- H. Section 32 17 26 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
- B. ACI 301 - Specifications for Concrete Construction.
- C. ACI 305R - Guide to Hot Weather Concreting.
- D. ACI 306R - Guide to Cold Weather Concreting.
- E. ACI 318 - Building Code Requirements for Structural Concrete.
- F. ADA Standards - 2010 ADA Standards for Accessible Design.
- G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- H. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- L. ASTM C150/C150M - Standard Specification for Portland Cement.
- M. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- N. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

- O. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
- P. CBC - California Building Code.
- Q. CBC Ch. 11B - California Building Code-Chapter 11B.
- R. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.

#### **1.05 QUALITY ASSURANCE**

- A. Lines and Levels: Established by State of California licensed Surveyor or registered Civil Engineer. Costs of surveying services shall be included in the Contract Sum.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

### **PART 2 PRODUCTS**

#### **2.01 PAVING ASSEMBLIES**

- A. Comply with applicable requirements of ACI 301.
- B. Concrete Sidewalks: 4,000 psi 28 day concrete, thickness as indicated on Drawings, minimum 4 inches, natural grey color Portland cement.
- C. Site Concrete: 4,000 psi 28 day concrete, thickness as indicated on Drawings, minimum 4 inches, natural grey color Portland cement.

#### **2.02 REGULATORY REQUIREMENTS**

- A. Conform to California Code of Regulations (CCR), Volume 2, Part 2, Chapters 18A and 19A.
- B. Conform to California Building Code (CBC), Chapter 11B and ADA Standards for accessibility requirements.
  - 1. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Ch. 11B-302 and 11B-403.
  - 2. Concrete paving and concrete finishes along accessible routes of travel shall be at least as slip-resistant as that described as a medium salted finish for slopes of less than 6%, and slip resistant at slopes of 6% or greater; CBC Ch. 11B-403.2.
  - 3. Accessible routes of travel, walks, paving, and sidewalks, shall have a continuous common surface with minimum width of 48 inches per CBC Ch. 11B-403.5.1, not interrupted by steps or by abrupt changes in level.
    - a. CBC Ch. 11B-303.2 Vertical: Changes in level exceeding 1/4 inch high maximum shall be permitted to be vertical and without edge treatment.
    - b. CBC Ch. 11B-303.3 Beveled: Changes in level between 1/4 inch high minimum and 1/2 inch high maximum shall be beveled with a slope not steeper than 1:2.
  - 4. Surface cross slopes shall not exceed 2 percent on any accessible path of travel.
- C. Albedo Reflectance of Finish Concrete: 0.30, minimum.

### **2.03 FORM MATERIALS**

- A. Form Materials: As specified in Section 03 10 00, comply with ACI 301.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
  - 1. Thickness: 1/2 inch.

### **2.04 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength; deformed billet steel bars; unfinished.
- B. Dowels: ASTM A615/A615M, Grade 60 - 60,000 psi yield strength; deformed billet steel bars; unfinished finish.
- C. Provide supports for reinforcement to position the bars at mid depth of the concrete. Plastic and/or steel chairs, and dobies are acceptable.

### **2.05 CONCRETE MATERIALS**

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150/C150M, Sulfate Resistant - Type V Portland cement, gray color.
- C. Fine and Coarse Mix Aggregates: ASTM C33/C33M.
- D. Water: Clean, and not detrimental to concrete.
- E. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing, Type C - Accelerating, and Type G - Water Reducing, High Range and Retarding.
  - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

### **2.06 ACCESSORIES**

- A. Curing Compound: ASTM C309, Type 1-D, Class A.
  - 1. Comply with all applicable air pollution requirements.
- B. Liquid Surface Sealer: <>
  - 1. Penetrating High solids, acrylic curing and sealing compound: Minimum 25% non-yellowing, acrylic solids curing compound; shall conform to ASTM C309 and/or ASTM C1315, Type I, Class A, VOC compliant.
    - a. Products:
      - 1) Laticrete International, Inc.; L&M Aquapel Plus: [www.lmcc.com](http://www.lmcc.com).
      - 2) L.M. Scofield Company (Sika Brand); Cureseal-W: [www.scofield.com](http://www.scofield.com).
      - 3) W. R. Meadows Company; Intraguard: [www.wrmeadows.com](http://www.wrmeadows.com).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
  - 1. Material: Closed-cell, non-absorbent, compressible polymer foam in sheet form.
- D. Tactile Warning Surfaces: See Section 32 17 26.



## **2.07 CONCRETE MIX DESIGN**

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Concrete Properties:
  - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; As scheduled.
  - 2. Water-Cement Ratio: Maximum 40 percent by weight, or according to indicated concrete strength..
  - 3. Maximum Slump: 4 inches.

## **2.08 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

### **3.02 SUBBASE**

- A. See Section 32 11 23 for construction of base course for work of this Section, where indicated on Drawings.

### **3.03 PREPARATION**

- A. Project Conditions:
  - 1. Water and Dust Control: Maintain control of concrete dust and water at all times. Do not allow adjacent planting areas to be contaminated.
- B. Moisten base to minimize absorption of water from fresh concrete.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

### **3.04 COORDINATION WITH EXISTING CONSTRUCTION**

- A. Connection to Existing Construction: Where new concrete is doweled to existing construction, drill holes in existing concrete, insert steel dowels and pack with non-shrinking grout.
- B. Preparation of Existing Concrete: Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.

### **3.05 FORMING**

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### **3.06 REINFORCEMENT**

- A. Place reinforcement at midheight of slabs-on-grade.
  - 1. Locate reinforcement to provide required cover by concrete. If not otherwise indicated on Drawings, provide concrete cover in compliance with ACI 318.
  - 2. Reinforcement Spacing: Space reinforcement as indicated on Drawings or in Standard Specifications, whichever is more stringent. If not indicated, maintain clear spacing of two times bar diameter but not less than 1-1/2 inch nor less than 1-1/3 times maximum size aggregate.
  - 3. Reinforcement Supports: Provide load bearing pads under supports or provide precast concrete block bar supports.
- B. Interrupt reinforcement at contraction and expansion joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.
  - 1. Secure tie dowels in place before depositing concrete.
  - 2. Provide No. 3 bars, 18 inch long at 24 inches O.C. for securing dowels where no other reinforcement is provided.

### **3.07 COLD AND HOT WEATHER CONCRETING**

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

### **3.08 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
  - 1. Mixing: If batch plant is within travel time not exceeding maximum limits, transit mix concrete in accordance with ASTM C94/C94M. If travel time exceeds limits, provide alternative means for mixing and submit for review and approval.
- B. Do not place concrete when base surface is wet.
- C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Place concrete to pattern indicated.

### **3.09 JOINTS**

- A. Align curb, gutter, and sidewalk joints.
- B. Place 1/2 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.

1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
  2. Secure to resist movement by wet concrete.
  3. If expansion joints are not indicated, conform to SSPWC (Greenbook) and standard details and specifications of authorities having jurisdiction.
- C. Provide scored joints.
1. Tooled Joints: 1-inch deep by 3/16-inch wide tooled joints with 1/8-inch radius corners.
  2. At 5 feet intervals for pedestrian paving.
  3. At 10 feet intervals for vehicle paving.
  4. Between sidewalks and curbs.
  5. Between curbs and pavement.
- D. Provide keyed joints as indicated.
- E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

### **3.10 FINISHING**

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Medium broom, texture perpendicular to pavement direction with troweled and radiused edge.
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- D. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### **3.11 TOLERANCES**

- A. ACI 301, Class B, except paving in public rights-of-way shall conform to SSPWC (Greenbook).
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- C. Maximum Variation From True Position: 1/4 inch.
- D. Control-joint grooves and other conspicuous lines:
  1. 1/4 inch maximum in any 20 feet.
  2. 1/2 inch maximum in any 40 feet.
- E. Variation in Cross-Sectional Thickness of Slabs:
  1. Minus 1/4 inch.
  2. Plus 1/2 inch.
- F. Variation in Radii
  1. In radii of less than 10 feet:
    - a. 1/8 inch in any 5 feet.
    - b. 1/4 inch in any 10 feet.
  2. In radii of 20 feet:
    - a. 1/4 inch in any 10 feet.

- b. 3/8 inch in any 20 feet
  - 3. In radii of 30 feet or more:
    - a. 1/2 inch in any 20 feet.
    - b. 1 inch in any 30 feet.
- G. Coefficient of Friction for Finish Surface:
  - 1. Pedestrian Vehicular Finish Surface: Minimum 0.6 static coefficient of friction is required for all concrete paving finish surface. All concrete paving surfaces to be broom finish.
  - 2. Ramps: Minimum 0.8 static coefficient of friction is required for all concrete paving finish surfaces on ramps. All concrete paving surfaces on ramps to be broom finish.

### **3.12 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
  - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
  - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
  - 3. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd or less of each class of concrete placed.
  - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
  - 2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

### **3.13 PROTECTION**

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
  - 1. Provide lumber ramping and plywood covering where curbs and gutters are subject to vehicular and equipment traffic during construction.

**END OF SECTION**

## **SECTION 32 13 16 DECORATIVE CONCRETE PAVING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Concrete decorative paving areas, stair steps, integral curbs, and architectural finish elements.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 35 33 - Stamped Concrete Finishing: Additional requirements for patterned surfaces.
- B. Section 31 22 00 - Grading: Preparation of site for paving and base.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
- C. ACI 301 - Specifications for Concrete Construction.
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- E. ACI 305R - Guide to Hot Weather Concreting.
- F. ACI 306R - Guide to Cold Weather Concreting.
- G. ADA Standards - 2010 ADA Standards for Accessible Design.
- H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- M. ASTM C150/C150M - Standard Specification for Portland Cement.
- N. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
- O. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- P. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- Q. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- R. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- S. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

- T. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- U. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- V. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- W. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- X. CBC - California Building Code.
- Y. CBC Ch. 11B - California Building Code-Chapter 11B.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meetings:
  - 1. Before submitting design mixtures, review decorative cement concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and decorative cement concrete pavement construction practices.
  - 2. Representatives of each entity directly concerned with decorative cement concrete pavement to attend:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixes.
    - c. Ready-mix concrete producer.
    - d. Decorative cement concrete pavement Installer.
    - e. Delete subparagraph below if manufacturer's representative is not required to be present.
  - 3. Manufacturer's representative of decorative cement concrete pavement system.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.
- C. Samples: Submit two sample panels, 12 by 12 inch in size illustrating exposed aggregate finish.

#### **1.06 QUALITY ASSURANCE**

- A. Lines and Levels: Established by State of California licensed Surveyor or registered Civil Engineer. Costs of surveying services shall be included in the Contract Sum.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
  - 1. The Installer shall provide a qualified foreman or supervisor who has a minimum of three years experience with imprinted and textured concrete, and who has successfully completed at least five similar installations of high quality and similar in scope to that required.

## **1.07 MOCK-UP**

- A. Construct mock-up comprised of one horizontal field sample panel, 4 feet long by 4 feet wide, with typical pattern, texture, surface finish, color, joints, caulking, sealant, full aggregate color range, and standard of workmanship represented.
  - 1. If multiple colors and finishes are specified, samples are required for each paving type and all mock ups shall be prepared for review at the same time.
- B. Locate where directed.
- C. Review mock-ups for approval by the Architect, Landscape Architect, and Owner before proceeding with the work.
  - 1. Mock-ups will be judged against the appearance of the Reference Panels.
  - 2. Mock-ups that do not match the Reference Panels and do not demonstrate all specified joints and joint materials, caulking, and scoring treatments will be rejected.
    - a. Remove and reconstruct the mock-ups until approved.
    - b. Contractor to be back charged for the costs of the Architect and Landscape Architect to review more than two (2) mock-up attempts.
  - 3. Approved mock-ups serve as standard of acceptance for paving work and remain available for the duration of the project.
- D. Mock-up may not remain as part of the Work.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS:**

- A. Conform to California Code of Regulations (CCR), Volume 2, Part 2, Chapters 18 and 19.
- B. Conform to California Building Code (CBC), Chapter 11B and ADA Standards for accessibility requirements.
  - 1. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Ch. 11B-302 and 11B-403.
  - 2. Concrete paving and concrete finishes along accessible routes of travel shall be at least as slip-resistant as that described as a medium salted finish for slopes of less than 6%, and slip resistant at slopes of 6% or greater; CBC Ch. 11B-403.2.
  - 3. Accessible routes of travel, walks, paving, and sidewalks, shall have a continuous common surface with minimum width of 48 inches per CBC Ch. 11B-403.5.1, not interrupted by steps or by abrupt changes in level.
    - a. CBC Ch. 11B-303.2 Vertical: Changes in level exceeding 1/4 inch high maximum shall be permitted to be vertical and without edge treatment.
    - b. CBC Ch. 11B-303.3 Beveled: Changes in level between 1/4 inch high minimum and 1/2 inch high maximum shall be beveled with a slope not steeper than 1:2.
  - 4. Surface cross slopes shall not exceed 2 percent on any accessible path of travel.
  - 5. Cast-In-Place colored concrete system meeting nominal dimensional and color contrast requirements of CBC Chapter 11B and ADA Standards.
- C. Albedo Reflectance of Finish Concrete: 0.30, minimum.

## **2.02 FORM MATERIALS**

- A. Wood form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
  - 1. Thickness: 1/2 inch.

## **2.03 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength; deformed billet steel bars; unfinished.
- B. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.
- C. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi yield strength; deformed billet steel bars; unfinished finish.
  - 1. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.
    - a. Thickness: 0.125 inch
    - b. Compression Resistance, ASTM D695: 5,500-8,000 PSI.
    - c. Products:
      - 1) BoMetals, Inc: [www.bometals.com/#sle](http://www.bometals.com/#sle).
      - 2) Sika Corporation; Speed Dowel: [usa.sika.com](http://usa.sika.com)
      - 3) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- D. Provide supports for reinforcement to position the bars at mid depth of the concrete. Plastic and/or steel chairs, precast concrete blocks, and dobies are acceptable.

## **2.04 CONCRETE MATERIALS**

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150/C150M, Air Entraining - Type IIA Portland cement, gray color.
- C. Fine and Coarse Mix Aggregates: ASTM C33/C33M.
- D. Exposed Aggregate: Quartz washed natural mineral aggregate, \_\_\_\_ inch minimum and \_\_\_\_ inch maximum size, \_\_\_\_\_ color, from a single source.
- E. Fly Ash: ASTM C618, Class F.
- F. Calcined Pozzolan: ASTM C618, Class N.
- G. Silica Fume: ACI 211.1.
- H. Water: Clean, and not detrimental to concrete.
- I. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
  - 1. Concentration: Base dosage rates on weight of Portland cement, fly ash, silica fume, and other cementitious materials but not aggregate or sand.
  - 2. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
  - 3. Manufacturers:



- a. Butterfield Color: [www.butterfieldcolor.com/#sle](http://www.butterfieldcolor.com/#sle).
  - b. Davis Colors: [www.daviscolors.com/#sle](http://www.daviscolors.com/#sle).
  - c. L.M. Scofield Company; CHROMIX® Admixtures for Color-Conditioned® Concrete: [www.scofield.com/#sle](http://www.scofield.com/#sle).
  - d. L.M. Scofield Company; SOLACHROME® Integral Coloring Treatment for High-SR Concrete: [www.scofield.com/#sle](http://www.scofield.com/#sle).
  - e. Solomon Colors; Solomon ColorFlo Liquid Colors: [www.solomoncolors.com/#sle](http://www.solomoncolors.com/#sle).
  - f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- J. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing, Type C - Accelerating, and Type G - Water Reducing, High Range and Retarding.

## 2.05 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1, Class A.
  - 1. Manufacturers:
    - a. Anti-Hydro Company; Clear Cure Water Base.
    - b. The Burke Company; Spartan Cote WB.
    - c. Cormix Construction Chemicals; Sealco VOC.
    - d. Conspec Marketing and MFG. Company; Aquafilm.
    - e. Euclid Chemical Company; Eucobar.
    - f. L&M Construction Chemicals; E-Con.
    - g. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- B. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, complying with ASTM C171.
- C. Liquid Surface Sealer: <>
  - 1. Penetrating High solids, acrylic curing and sealing compound: Minimum 25% non-yellowing, acrylic solids curing compound; shall conform to ASTM C309 and/or ASTM C1315, Type I, Class A, VOC compliant.
    - a. Products:
      - 1) Laticrete International, Inc.; L&M Aquapel Plus: [www.lmcc.com](http://www.lmcc.com).
      - 2) L.M. Scofield Company (Sika Brand); Cureseal-W: [www.scofield.com](http://www.scofield.com).
      - 3) W. R. Meadows Company; Intraguard: [www.wrmeadows.com](http://www.wrmeadows.com).
      - 4) Or Equal Substitutions: See Section 01 6000 - Product Requirements.
- D. Surface Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Color: As selected by Architect from manufacturer's standard range.
  - 2. Basis of Design Product: TOP-CAST® Top-Surface Retarder as manufactured by GCP Applied Technologies, or equal.
  - 3. Manufacturers:
    - a. Fosroc, Inc.; Preco EAC-S: [fosroc.com](http://fosroc.com)

- b. GCP Applied Technologies; Grace TopCast: [gcpat.com](http://gcpat.com)
  - c. The Euclid Chemical Company; EZ Expose: [www.euclidchemical.com](http://www.euclidchemical.com).
  - d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- 4. Spray applied film forming protective coating for surfaces adjacent to retarded finish surfaces.
  - a. Basis of Design Product: Top-Cast SS 100 as manufactured by GCP Applied Technologies, or equal.
  - b. Acceptable Products:
    - 1) Fosroc, Inc.: [fosroc.com](http://fosroc.com).
    - 2) GCP Applied Technologies; Top-Cast SS 100: [gcpat.com](http://gcpat.com).
    - 3) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- E. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
  - 1. Material: Closed-cell, non-absorbent, compressible polymer foam in sheet form.

## **2.06 CONCRETE MIX DESIGN**

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Concrete Properties:
  - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 4,000 psi.
  - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  - 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
  - 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
  - 5. Water-Cement Ratio: Maximum 40 percent by weight.
  - 6. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
  - 7. Maximum Slump: 3 inches.

## **2.07 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

- B. Verify gradients and elevations of base are correct.

### **3.02 SUBBASE**

- A. See Section 32 11 23 for construction of base course for work of this Section.

### **3.03 PREPARATION**

- A. Moisten base to minimize absorption of water from fresh concrete.

### **3.04 FORMING**

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### **3.05 REINFORCEMENT**

- A. Place reinforcement at midheight of slabs-on-grade.
- B. Interrupt reinforcement at contraction joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.

### **3.06 COLD AND HOT WEATHER CONCRETING**

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

### **3.07 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Do not place concrete when base surface is wet.
- C. Ensure reinforcement, inserts, embedded parts, formed joints and \_\_\_\_ are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

### **3.08 JOINTS**

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
  - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
  - 2. Secure to resist movement by wet concrete.
- C. Provide scored joints.
  - 1. At 5 feet intervals.

- 2. Between sidewalks and curbs.
- 3. Between curbs and pavement.
- D. Provide keyed joints as indicated.
- E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

### **3.09 EXPOSED AGGREGATE**

- A. Wash scheduled concrete surfaces with acid etch solution exposing aggregate to match sample panel.

### **3.10 FINISHING**

- A. Float Finish: After placing concrete, tamp with heavy grille tamper until at least 3/8" of mortar has been brought to the surface, as soon as the surface becomes workable, push down all coarse aggregate, filling all holes and leveling surface to a true and even surface.

### **3.11 TOLERANCES**

- A. Comply with tolerances of ACI 117.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- C. Maximum Variation From True Position: 1/4 inch.
- D. Thickness: Plus 3/8 inch, minus 1/4 inch.
- E. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
- F. Lateral Alignment and Spacing of Dowels: 1 inch.
- G. Vertical Alignment of Dowels: 1/4 inch.
- H. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
- I. Joint Spacing: 3 inches.
- J. Contraction Joint Depth: Plus 1/4 inch, no minus.
- K. Joint Width: Plus 1/8 inch, no minus.

### **3.12 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
  - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
  - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
  - 3. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
  2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

### **3.13 PROTECTION**

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

**END OF SECTION**

**SECTION 32 14 13**  
**PRECAST CONCRETE UNIT PAVING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Non-interlocking concrete paver units and detectable warning pavers.
- B. Detectable warning pavers.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Preparation of subsoil for pavers.
- B. Section 32 11 23 - Aggregate Base Courses: Aggregate subbase for pavers.
- C. Section 32 13 13 - Site Concrete: Concrete subbase for pavers.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide characteristics of paver unit, detectable warning pavers, dimensions, and special shapes.
- C. Product Data: Provide characteristics of polymeric sand, including base material, additive(s), compressive strength, and color.
- D. Samples: Submit two samples of each paver type, illustrating style, size, color range and surface texture of units being provided.
- E. Manufacturer's Installation Instructions: Indicate substrate requirements and installation methods.
- F. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Pavers: 10 of each type and size.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Non-interlocking Concrete Pavers:
  - 1. Oldcastle: [www.oldcastle.com/#sle](http://www.oldcastle.com/#sle).
  - 2. Orco Pavingstones: [orcopaverwalls.com](http://orcopaverwalls.com).
  - 3. Stepstone Inc: [www.stepstoneinc.com](http://www.stepstoneinc.com).
  - 4. Tectura Designs, a division of Wausau Tile Inc: [www.tecturadesigns.com/#sle](http://www.tecturadesigns.com/#sle).
  - 5. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 MATERIALS**

- A. Non-interlocking Pavers: Precast concrete.
  - 1. Compressive Strength: Minimum of 7200 pounds per square inch.
  - 2. Absorption: 5 percent average, with maximum of 7 percent.
  - 3. Air Entrainment: 5 to 7 percent.
  - 4. Size: 12 by 12 inches.
  - 5. Thickness: 2 inches.
  - 6. Color: Natural.
- B. Detectable Warning Pavers: Cast concrete with truncated domes, yellow color.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.
- B. Verify gradients and elevations of substrate are correct.

### **3.02 PREPARATION**

- A. Treat soil with herbicide to retard plant growth.

### **3.03 INSTALLATION OF SOLID PAVER UNITS**

- A. Spread sand bedding evenly over prepared substrate surface to a maximum thickness of 1-1/2 inch.
- B. Dampen and roller compact sand to level and even surface.
- C. Screed and scarify top 1 inch to 1 1/2 inch of sand.
- D. Cut paver units at edges with masonry saw.
- E. Place half units at edge and interruptions. Maintain tight joints.
- F. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients. Do not tamp unrestrained edges.

**END OF SECTION**

**SECTION 32 15 00**  
**AGGREGATE SURFACING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Crushed stone surfacing. (Stabilized decomposed granite walkways)
- B. Walkway edging installation.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 10 00 - Site Clearing.
- B. Section 31 22 00 - Grading: Preparation of subbase.

**1.03 REFERENCE STANDARDS**

- A. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- C. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- D. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
- E. CBC Ch. 11B - California Building Code-Chapter 11B.
- F. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Products Data: For each product specified. Submit a 5 lb. sample and sieve analysis for grading of decomposed granite or crushed 3/8" or 1/4" minus aggregate to be sent to Manufacturer prior to any construction – (allow 2 week turn around).
- C. Test Reports:
  - 1. Submit sieve analysis of proposed material to insure it meets grading requirements.
  - 2. Test Results: Supplied by an independent testing laboratory for compliance of gradation of decomposed granite material in accordance with ASTM C136/C136M.
- D. Sieve analysis and color of decomposed granite screenings shall be approved in writing from the Architect before any material is delivered to the project site.
- E. Manufacturer's Instructions: Include aggregate base course placement, installation procedures, and fill placement.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Samples:



1. Products: Five lb. sample and sieve analysis for grading of decomposed granite. Color shall be as specified on the Drawings, or as selected by Architect.
- I. Certificates: Certify that products of this section meet or exceed specified requirements.
- J. Provide Owner Representative with the following excess materials for use in future Stabilized Aggregate repair: 40 to 50 lb. Bags of the Stabilized Aggregate blended with proper amount of Stabilizer

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least three years of documented experience and approved by manufacturer.
- C. Paving: Replace without additional cost to the Owner all areas of decomposed granite surface that may become defective within one (1) year after date of acceptance.
- D. Sterilization: Maintain all areas of decomposed granite surface free of vegetation growing through from below for (90) days after date of acceptance. Any procedure required for eradication of such vegetation growth shall be done by the Contractor at no additional cost to the Owner.
- E. Regulatory Requirements:
  1. Placement of surfacing to comply with CBC Ch. 11B-302 Floor and Ground Surfaces, 11B-303 Changes in Level, and 11B-403 Walking Surfaces.
  2. Surfacing shall be stable, firm, and slip resistant and shall comply with CBC Ch. 11B-302 and 11B-403.

#### **1.06 MOCK-UPS:**

- A. Install 4 ft. wide x 10 ft. long mock-up of decomposed granite with stabilizer additive at location as directed by Architect.
- B. Mock to be the standard from which the work will be judged and incorporated into the work.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 60 00 - Product Requirements for additional requirements.
- B. Identify, store, and handle geosynthetics according to ASTM D4873/D4873M.
- C. Protect geosynthetic materials from sunlight and other ultraviolet light sources during storage.
- D. Handle geosynthetics with care and prevent dragging, dropping, or imbalanced lifting.

#### **1.08 FIELD CONDITIONS**

- A. Use lightweight hauling equipment.
- B. Exercise care in using equipment, avoiding damage to adjacent paving, walls and plant materials.
- C. Do not install decomposed granite surface material during rainy conditions or below 40 degrees.

- D. Temperature Requirements: Do not place geosynthetic when ambient air or base surface temperature is less than 40 degrees F or above 140 degrees F (60 degrees C).
- E. Surface Requirements: Do not place geosynthetic when the receiving surface is saturated or has ponded water.

## 1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide one year manufacturer warranty for performance. Complete forms in Owner's name and register with manufacturer.
- C. Installer Special Warranty: Provide 2-month (60 days) warranty for unconditional maintenance and repairs as required commencing on the Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURER

- A. Basis of Design Product: Decomposed Granite as manufactured by Gail Materials, or approved equal.
- B. Acceptable Supplier:
  - 1. Gail Materials: [www.gailmaterials.net](http://www.gailmaterials.net)
  - 2. Southwest Boulder & Stone: [www.southwestboulder.com](http://www.southwestboulder.com), or equal.
  - 3. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

### 2.02 MATERIALS

- A. Crushed Stone Surfacing: Natural, washed, 3/8 inch (1 cm) stone; free of shale, clay, friable material, and debris.
  - 1. Decomposed Natural Friable Granite Screenings for Walkways.
  - 2. Conform to the grading requirements shown below.
    - a. Do not use limestone screenings or stone dust.
  - 3. Color(s): To be selected by Architect from manufacturer's full range.
  - 4. Sieve Analysis: In accordance with ASTM C136/C136M.

SIEVE DESIGNATION	PERCENT PASSING
1/2 inch	100
3/8 inch	90 - 100
No. 4	50 - 100
No. 30 (0.600 mm)	25 - 55
No. 100 (0.150 mm)	10 - 20
No. 200 (0.075 mm)	5 - 18

- a. Sand Equivalent: 30 minimum in accordance with ASTM D2419.
- 5. Provide screenings of clean, hard, durable particles or fragments of select granite.
  - a. Evenly mix fines throughout the aggregate.

- b. Material with one fractured face produced from gravel; Provide 50 percent retained on a No. 4 sieve, by weight.
  - 6. Source Quality Control:
    - a. See Section 01 40 00 - Quality Requirements, for additional requirements.
    - b. Provide the entire quantity required from a single supply source.
- B. Stabilizer Binder:
  - 1. Patented, non-toxic, organic binder that is a colorless and odorless concentrated powder that binds decomposed granite together to produce a firm surface.
  - 2. Products:
    - a. Basis of Design Product: Natracil as Distributed by Gail Materials, or approved equal.
    - b. Minick Materials; Natracil: [www.minickmaterial.com](http://www.minickmaterial.com).
    - c. Stabilizer Solutions, Inc.; Stabilizer® for Stabilized Aggregate: [stabilizersolutions.com](http://stabilizersolutions.com).
    - d. Technisoil Global, Inc.; TechniSoil G3 - Commercial Stabilizer : [technisoil.com](http://technisoil.com).
    - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- C. Geosynthetic Fabric: Comply with SSPWC (Greenbook) Section 213-2 – “Geosynthetics”, Type N90.
- D. Aggregate Base Course: According to surface reinforcement manufacturer's recommendations.

## 2.03 ACCESSORIES

- A. Steel Edging:
  - 1. Dimensions: 3/16 inch thick by 4 inches deep, with overlapping joints.
  - 2. Stakes: 3/16 inch by 16 inches long x 1-3/4 inch wide at top tapering to point at bottom; located 36 inches o.c. maximum.
  - 3. Finish: Baked-on green paint, Baked-on brown paint, Baked-on black paint, or Hot-dipped galvanized.
  - 4. Color(s): To be selected by Architect from manufacturer's full range.
- B. Redwood Edging:
  - 1. Material: RIS Merchantable Heart Grade.
  - 2. Dimensions: Nominal 1 x 4 inches.
  - 3. Stakes: Nominal 2 x 2 inches by 16 inches long; located 36 inches o.c. maximum.
- C. Recycled Plastic Lumber Edging:
  - 1. Material: Lumber made from recycled polyethylene and UV stabilizers.
  - 2. Dimensions: Nominal 2 x 4 inches.
  - 3. Steel Stakes: 3/16 inch by 16 inches long x 1-3/4 inch wide at top tapering to point at bottom; located 36 inches o.c. maximum.
  - 4. Color(s): To be selected by Architect from manufacturer's full range.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subgrade has been prepared correctly, is smooth, and is at proper grade and level.
- B. Do not begin work until subgrade is correct.

### **3.02 INSTALLATION**

- A. Edging: Install flush with stabilized decomposed granite surfacing.
  - 1. Provide sufficient stakes to secure in place.
- B. Install aggregate base course according to surface reinforcement manufacturer's recommendations.
  - 1. Base shall be 3 inch compacted layer of recommended crushed granular road base. Make any corrections necessary to base furnished and installed to bring gravel to the elevations shown on the drawing.
  - 2. Pre-soak base material with water and compact to 95% determined by Test Method ASTM D1557 prior to installing Stabilized Aggregate. Compaction testing to be provided by project owner, one test per 2,000 square feet of base.
  - 3. Although porous, it is recommended to have proper drainage available to ensure no standing water on surface or adjacent to Stabilized Aggregate, including downspouts when placed under roof overhang and surface drains.
  - 4. Blending Stabilizer:
    - a. Thoroughly pre-mix stabilizer with aggregate at the rate of 15-lbs of stabilizer per 1-ton of aggregate. Verify with manufacturer correct stabilizer rate for your project and climate. Drop spreading of stabilizer over pre-placed aggregate or mixing by rototilling is not acceptable. Mechanically pre-mix stabilizer per manufacturer's recommendations using an approved mechanical blending unit to adequately blend stabilizer with aggregate (Bucket blending is not an approved blending apparatus). Always dry blend stabilizer and aggregate.
  - 5. Placement:
    - a. After pre-blending, place Stabilized Aggregate directly on prepared sub-grade. Level to desired grade and cross section. Depth of pathways shall be 3" for heavy foot traffic and light vehicles. DO NOT place on filter fabric. Contact manufacturer for installation on slopes greater than 8%.
  - 6. Watering:
    - a. Water heavily for full-depth moisture penetration of profile. Water activates stabilizer. Apply 25 to 45-gallons of water per 1-ton to achieve saturation. Randomly test for depth using a probing device, which reaches full depth.
    - b. Wait a minimum of 6 – 72 hours or until such time that the stabilized aggregate is able to accept compaction from a 1 to 5 ton roller without separation, plowing or any other physical compromise of the aggregate.
    - c. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.

7. Compaction:

- a. Compact stabilized aggregate to 85% relative compaction by equipment such as; a 2 to 5-ton double drum roller making 3 to 4 passes. Do not begin compaction for 6 hours after placement and up to 72 hours. DO NOT use a vibratory plate compactor or vibration feature on roller, as vibration separates large aggregate particles. If pumping or pancaking of surface occurs, surface is still too wet to roll.
  - b. Take care in compacting surface when adjacent to planting and irrigation systems, use 8" or 10" hand tamp. Install stabilized aggregate more than 3" thick, in lifts. If 4" thick compacted (2) 2" lifts. If 5" thick compacted (2) 2.5" lifts. If stabilized aggregate is pre-moistened before installation entire 4" or 5" lift may be installed.
  - c. Lightly spray surface area following compaction. Do not disturb aggregate surface with spray action.
- C. Place surfacing or aggregate-turf pavement in maximum 4 inch (100 mm) layers.

### 3.03 CLEANING

- A. Remove unused or stockpiled fill, base, and reinforcement.
- B. Clean adjacent surfaces of excess sand, gravel, soil, and debris. Sweep broom clean.

### 3.04 PROTECTION

- A. Furnish and install construction fence around new surface to prevent public access. Fencing to be maintained in place for a minimum of 12 - 72 hours after completion of installation, or as directed by the Owner Representative. Drying period may take longer due to weather conditions.
- B. Contractor shall notify Owner Representative that landscape irrigation shall be restricted near Stabilized Aggregate surface until drying period is complete. Standing water on surface and adjacent to path shall be restricted at all times.

### 3.05 MAINTENANCE

- A. Remove debris, such as paper, grass clippings, or organic material by mechanically blowing or hand raking as needed. When plowing snow, use rubber baffle on plow blade or wheels on plow to lift blade 1/4" off the surface.
- B. During first year, minor amounts of loose aggregate may appear on surface (1/16 to 1/4"). If material exceeds a 1/4", redistribute over entire surface. Water to 1" depth and compact with power roller of no less than 1000-lbs. Repeat as needed. If cracking occurs, sweep fines into cracks, water thoroughly and hand tamp with an 8" – 10" hand tamp.

### 3.06 REPAIRS

- A. Excavate damaged area to the depth of the Stabilized Aggregate and square off sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. Pre-blend the dry required amount of Stabilizer® with the proper amount of aggregate in a concrete mixer.
- D. Add water to the pre-blended Stabilized Aggregate. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.

- E. Apply moistened pre-blended Stabilized Aggregate to excavated area to finish grade.
- F. Compact with an 8" to 10" hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

**END OF SECTION**

## **SECTION 32 17 13 CONCRETE WHEEL STOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Precast concrete parking bumpers and anchorage.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 32 17 23 - Pavement Markings.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- B. ASTM C150/C150M - Standard Specification for Portland Cement.
- C. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
- D. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide unit configuration, dimensions.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Parking Bumpers: Precast concrete, complying with the following:
  - 1. Profile: Manufacturer's standard.
  - 2. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
  - 3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
  - 4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
  - 5. Air Entrainment Admixture: ASTM C260/C260M.
  - 6. Concrete Mix: Minimum 5,000 psi compressive strength after 28 days, air entrained to 5 to 7 percent.
  - 7. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
  - 8. Embed reinforcing steel, and drill or sleeve for two dowels.
  - 9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

- 10. Minor patching in plant is acceptable, providing appearance of units is not impaired.
- B. Dowels: Cut reinforcing steel, 1/2 inch diameter, 1 inch long, pointed tip.
- C. Adhesive: Epoxy type.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install units without damage to shape or finish. Replace or repair damaged units.
- B. Install units in alignment with adjacent work.
- C. Fasten units in place with 2 dowels per unit.

**END OF SECTION**



## **SECTION 32 17 23 PAVEMENT MARKINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Painted pavement markings.
  - 1. Accessible Parking Spaces.
  - 2. Existing Striping: Confirm compliance at all accessible parking spaces on site and path of travel with California Building Code and Access requirements.
    - a. Remove non-compliant and provide all striping and modifications necessary for compliance.
- B. Raised pavement markings.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 32 12 16 - Asphalt Paving.
- B. Section 32 13 13 - Site Concrete.
- C. Section 32 17 13 - Concrete Wheel Stops.
- D. Section 32 17 26 - Tactile Warning Surfacing.

#### **1.03 REFERENCE STANDARDS**

- A. AASHTO M 237 - Standard Specification for Epoxy Resin Adhesives for Bonding Traffic Markers to Hardened Portland Cement and Asphalt Concrete.
- B. AASHTO M 247 - Standard Specification for Glass Beads Used in Pavement Markings.
- C. AASHTO MP 24 - Standard Specification for Waterborne White and Yellow Traffic Paints.
- D. ADA Standards - 2010 ADA Standards for Accessible Design.
- E. CBC Ch. 11B - California Building Code-Chapter 11B.
- F. FS TT-B-1325 - Beads (Glass Spheres) Retro-Reflective.
- G. FS TT-P-1952 - Paint, Traffic and Airfield Marking, Waterborne.
- H. SAE AMS-STD-595 - Colors Used in Government Procurement.
- I. SAE AMS-STD-595A - Colors Used in Government Procurement.
- J. SCAQMD 1113 - Architectural Coatings.
- K. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work of this section with adjoining work.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
- C. Certificates: Submit for each batch stating compliance with specified requirements.
  - 1. Painted pavement markings.
  - 2. Raised pavement markings.
- D. Manufacturer's Instructions:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements for additional provisions.
  - 2. Extra Paint: 2 containers, 1 gallon size, of each type and color.
  - 3. Extra Markers: 5 percent, of each type and color.

### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.
- B. Deliver glass beads in containers suitable for handling and strong enough to prevent loss during shipment, accompanied by batch certificate.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

### **1.08 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.
  - 1. Do not apply marking paint when weather is foggy or rainy, or when such conditions are anticipated within eight hours of application.
  - 2. Do not apply marking paint when wind velocity causes uncontrollable overspray or excessively rapid drying.

- C. Sequence and Schedule: Apply pavement markings after asphaltic concrete and portland cement concrete and interlocking concrete paving Work are complete and properly cured and, if applicable, sealer has been applied to asphaltic concrete and landscaping Work is complete.
  - 1. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

## **1.09 SEQUENCING**

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of markings.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS:**

- A. Comply with CalGreen requirements.
  - 1. Comply at time of installation with Air Quality standards of:
    - a. South Coast Air Quality Management District, SCAQMD 1113.
    - b. California Air Resources Board (CARB).
- B. For accessibility markings see Part 3 Article "Installation".
- C. Conform to State of California, Department of Transportation (CALTRANS) Standard Specifications, Section 84, Traffic Control Markings, as amended and adopted by authorities having jurisdiction.
- D. Where reference is made to Standard Specifications, the following shall apply.
  - 1. Perform off-site Work in public rights-of-way in accordance with requirements of authorities having jurisdiction. For conditions not indicated otherwise on Contract Drawings, conform to Standard Details adopted by authorities having jurisdiction, including SSPWC (Greenbook).
  - 2. Perform on-site Work as indicated and referenced on the Contract Drawings and as specified herein.

### **2.02 MANUFACTURERS**

- A. Painted Pavement Markings:
  - 1. Vista Paint Corporation; 6700 100%Acrylic Traffic Marking Paint: [www.vistapaint.com](http://www.vistapaint.com).
  - 2. Behr: [www.behr.com](http://www.behr.com).
  - 3. Dunn Edwards: [www.dunnedwards.com](http://www.dunnedwards.com).
  - 4. Sherwin Williams; 2 Coats of SW Armorseal 8100 with Armorseal High Wear Additive in second coat: [www.sherwin.com](http://www.sherwin.com).
  - 5. Substitutions: Or equal.
- B. Raised Pavement Markings:
  - 1. Traffice Signs Corporation: [www.trafficsigns.com](http://www.trafficsigns.com).
  - 2. Substitutions: Or equal.

## 2.03 PAINTED PAVEMENT MARKINGS

- A. General: Provide standard factory-mixed, quick drying and non-bleeding colors, conforming to Standard Specifications, as amended and adopted by the AHJ, City, and County, as applicable.
- B. Painted Pavement Markings: As indicated on drawings.
  - 1. Marking Paint: In accordance with AASHTO MP 24.
    - a. Parking Lots: Color(s) as indicated.
      - 1) Fast-dry type. If required by authorities having jurisdiction for Work in public rights-of-way, include reflective material in paint. Paint for marking curbs shall not require reflective material. See Color Schedule in Part 3.
    - b. Symbols and Text: Color(s) as indicated.
      - 1) Accessibility Symbols: Provide blue and white, per CBC Ch. 11B-503 and CBC Ch. 11B-703.7.2.
        - (a) Blue shall conform to Color No. 15090; SAE AMS-STD-595A (formerly 595C).
  - 2. Reflective Glass Beads at Accessible Parking Spaces: Type 1 (low index of refraction), Gradation A (coarse, drop-on); with silicone or other suitable waterproofing coating to ensure free flow, in accordance with AASHTO MP 24 or FS TT-P-1952.
    - a. Comply with CBC Section 11B-502.6.4 Marking.
  - 3. Obliterating Paint: Type I, in accordance with AASHTO MP 24 or FS TT-P-1952.
    - a. Bituminous Pavement: Black.
    - b. Concrete Pavement: Gray.
- C. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

## 2.04 RAISED PAVEMENT MARKINGS

- A. Surface Reflectors: Bidirectional, visible to approaching traffic; capable of withstanding pavement-rated loading.
  - 1. For on-site fire hydrant locations, placed as required by local fire department.
  - 2. Housing: Plastic, blue.
  - 3. Lens: Prismatic, acrylic, blue.
    - a. Optical Performance: Reflective intensity of reflecting surface at 1/5 degree divergence angle shall be not less than the following when the incident light is parallel.

<u>Horiz. Eng. Angle</u>	<u>Blue</u>
0 Degrees	3.0
20 Degrees	1.5
  - 4. Dimensions: 4 inches by 4 inches (102 mm by 102 mm).
  - 5. Mounting Adhesive: Type I, in accordance with AASHTO M 237.
  - 6. Pavement Projection: 1/2 inch (12 mm).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Identify existing markings for removal.
- B. Verification of Conditions: Verify that pavement is dry and ready for installation.
- C. Notify Architect of unsatisfactory conditions before proceeding.

### **3.02 PREPARATION**

- A. Establish survey control points for locating and dimensioning of markings.
  - 1. Lay out markings as shown on Drawings. Use guide lines, templates and forms for precise edges and spacings.
    - a. At off-site and on-site public rights-of-way, obtain review and approval of layout by authorities having jurisdiction.
- B. Clean surfaces prior to installation.
  - 1. Remove dust, dirt, and other debris.
  - 2. Remove rubber deposits, existing paint markings, and other coatings.
- C. Temporary Markings: Apply as directed by Architect.
- D. Apply paint stencils by type and color at necessary intervals.

### **3.03 INSTALLATION**

- A. Regulatory Accessibility Requirements for Installation:
  - 1. Pavement markings for disability requirements shall meet requirements of California Building Code (CBC), Title 24, Part 2, CBC Ch. 11B and ADA Standards, per latest amendments.
    - a. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Ch. 11B-208.3.1.
    - b. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
    - c. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Ch. 11B-208.3.1
    - d. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Ch. 11B Table 11B-208.2 for each parking facility provided on a site.
    - e. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CBC Ch. 11B-208.2.4
    - f. Accessible parking spaces and access aisles shall comply with CBC Ch. 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:
      - 1) Parking spaces and access aisles shall be marked according to CBC Ch. 11B Figures 11B-502.2, 11B-502.3, and 11B-502.3.3.

- (a) Their surfaces shall comply with CBC Ch. 11B-302 and shall be at the same level with slopes not steeper than 1:48 in any direction. CBC Ch. 11B-502.4.
- 2) Parking spaces shall be 9 x 18 feet minimum and van parking spaces shall be 12 x 18 feet minimum with an adjacent access aisle of 5 x 18 feet minimum.
  - (a) Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces.
  - (b) Van parking spaces shall be permitted to be 9 x 18 feet minimum where the access aisle is 8 x 18 feet minimum.
- 3) Access aisles shall be marked by a blue painted borderline around their perimeter.
  - (a) The area within the blue borderlines shall be marked with hatched lines a maximum of 36 inches on center in a color contrasting with that of the aisle surface, preferably blue or white.
  - (b) Access aisle markings may extend beyond the minimum required length. CBC Ch. 11B-502.3.3
  - (c) At drive aisle provide minimum 12 inch high white letters with the text "NO PARKING" per CBC Ch. 11B Figure 11B-502.3.3.
- 4) Access aisles (parking spaces as well- similar application) shall not overlap the vehicular way. CBC Ch. 11B-502.3.4
- 5) A vertical clearance of 98 inches minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Ch. 11B-502.5

B. General:

- 1. Position pavement markings as indicated on drawings.
- 2. Field location adjustments require approval of Architect.

C. Painted Pavement Markings:

- 1. Apply in accordance with manufacturer's instructions.
- 2. Obliterating Paint: Apply as necessary to cover existing markings completely.
- 3. Marking Paint: Apply uniformly, with sharp edges.
  - a. Applications: One coat.
  - b. Wet Film Thickness: 0.015 inch, minimum.
  - c. Stencils: Lay flat against pavement, align with striping, remove after application.
  - d. Glass Beads: Apply directly to paint, 10 second lag time, 6 lbs/gal of paint, uniform thickness and coverage.
  - e. Length Tolerance: Plus or minus 3 inches.
  - f. Width Tolerance: Plus or minus 1/8 inch.
- 4. Curbs: Paint full vertical face and first 6-inches of horizontal plane at top of curb or combination curb/paving. Provide minimum 2 coats paint.
  - a. Provide stenciled text in the height, spacing and typeface as indicated on Drawings.

5. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
    - a. Mark the International Symbol of Accessibility at indicated parking spaces.
      - 1) Accessibility Logo: Provide minimum of 2 coats paint.
        - (a) Comply with CBC Ch. 11B Figure 703.7.2.1.
      - 2) Stall Marking:
        - (a) Use single-line style striping between parking stalls, unless otherwise indicated.
        - (b) Comply with local agency regulatory requirements.
        - (c) Accessible Stalls: Comply with ADA Standards, CBC Ch. 11B, and local agency regulatory requirements.
          - (1) Painted lines and markings on pavement shall be minimum 3 inches wide, color as indicated on Drawings
          - (2) Tactile warning lines shall comply with CBC Ch. 11B-705.1.2.5 Hazardous Vehicular Areas.
          - (3) Tactile warning devices shall comply with CBC Ch. 11B, see Section 32 17 26 - Tactile Warning Surfacing.
      - 3) Hatching: Provide hatching in parking areas, including accessible parking stalls, as indicated on Contract Drawings or as required by Standard Details. Should Contract Drawings and Standard Details conflict, comply with the more stringent.
    - b. Hand application by pneumatic spray is acceptable.
  6. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.
  7. Recreational Areas: Provide minimum 2 coats paint.
- D. Raised Pavement Markings:
1. Install in accordance with manufacturer's instructions in manner necessary to maintain manufacturer's warranty.
  2. Surface Reflectors:
    - a. Cut pavement and remove depth equal to height of reflector.
    - b. Partially fill area with road marker epoxy adhesive.
    - c. Press reflector into adhesive and apply pressure.

### **3.04 TOLERANCES**

- A. Maximum Variation From True Position: 3 inches (76 mm).
- B. Maximum Offset From True Alignment: 3 inches (76 mm).

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field inspection for deviations from true alignment or material irregularities.

- C. If inspections indicate work does not meet specified requirements, rework and reinspect at no cost to Owner.
- D. Allow the pavement marking to set at least the minimum time recommended by manufacturer.

### 3.06 CLOSEOUT ACTIVITIES

- A. Temporary Markings: Remove without damaging surfaces.

### 3.07 PROTECTION

- A. Replace damaged or removed markings at no additional cost to Owner.
- B. Preserve survey control points until pavement marking acceptance.

### 3.08 COLOR SCHEDULE

- A. Parking and On-Site Roadways

<u>Location</u>	<u>Color</u>	<u>Reflectance*</u> *
Driving lane striping	White	82%
Parking space striping	White	82%
Accessible Parking, field behind ISA, and zone markings	Blue No. 15090 per SAE AMS-STD-595A (formerly FED-STD-595C)	52%
Accessible Parking ISA, loading and cross-hatching	A. White with Blue perimeter at Asphalt Paving. B. Blue at Concrete Paving*	82% / 52% 52%
12 inch high Text: "NO PARKING", "LOADING ZONE", and "FIRE LANE", etc.	White	82%
Firelanes / No Parking zone markings Special Use Markings	Red No. 31350 per SAE AMS-STD-595A (formerly FED-STD-595C)	52%
Loading zone markings	Orange Yellow No. 33538 per SAE AMS-STD-595A (formerly FED-STD-595C)	52%
Directional arrows	White	82%
Speed Bumps	Orange Yellow No. 33538 per SAE AMS-STD-595A (formerly FED-STD-595C)	52%
Black special-use pavement markings, if indicated on Drawings	Black No. 37038 per SAE AMS-STD-595A (formerly FED-STD-595C)	NA



\*Contrasting color per CBC.

a. See also Division of the State Architect IR 11B-7.

\*\*Daylight directional reflectance (without glass beads) , when tested in accordance with Federal Test Method Standard 141A, Method 612.

**END OF SECTION**

## **SECTION 32 17 26 TACTILE WARNING SURFACING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for sidewalks and platforms.
- B. Section 32 13 13 - Site Concrete: Concrete sidewalks.
- C. Section 32 17 23 - Pavement Markings: Crosswalk and curb markings.

#### **1.03 REFERENCE STANDARDS**

- A. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA).
- B. AASHTO LRFD - Bridge Design Specifications.
- C. ADA Standards - 2010 ADA Standards for Accessible Design.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- F. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
- G. ASTM C903 - Standard Practice for Preparing Refractory Specimens by Cold Gunning.
- H. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
- I. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- J. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
- K. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- L. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- M. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- O. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials.
- P. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.
- Q. CBC Ch. 11B - California Building Code-Chapter 11B.
- R. SAE AMS-STD-595 - Colors Used in Government Procurement.

- S. SAE AMS-STD-595A - Colors Used in Government Procurement.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.
- C. Samples: For each product specified provide two samples, 8 inches square, minimum; show actual product, color, and patterns.
- D. Shop Drawings: Submit plan and detail drawings. Indicate:
  - 1. Locations on project site. Demonstrate compliance with referenced accessibility standards.
  - 2. Sizes and layout.
  - 3. Pattern spacing and orientation.
  - 4. Attachment and fastener details, if applicable
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Warranty: Submit manufacturer warranty; complete forms in Owner's name and register with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.
- B. Installer Qualifications: Company certified in writing by product manufacturer as having successfully completed work substantially similar to the work of this section.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver to project site in manufacturer's protective wrapping and in manufacturer's unopened packaging.
- B. Store covered and elevated above grade and in manufacturer's unopened packaging until ready for installation. Maintain at ambient temperature between 40 and 90 degrees F.

#### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Plastic Tiles: Provide manufacturer's standard five year warranty against manufacturing defects, breakage or deformation.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Detectable warnings shall comply with California Building Code, CBC Ch. 11B-705.1 requirements, CBC Ch. 11B-705.1.2 Locations and CBC Ch. 11B-705.1.2.5 Blended Transitions, for special warnings for disabled persons.

- B. Nominal dimensions meeting CBC Ch. 11B-705.1.2 Locations.
- C. Detectable warning surfaces at transit boarding platform edges, bus tops, vehicle areas, reflecting pools, and track crossings shall be yellow and approximate Federal Color No. 33538 as shown in SAE AMS-STD-595A (Table IV of Federal Standard No. 595A).
- D. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. CBC Ch. 11B-705.1.1.4 Resiliency.
- E. Color yellow for detectable warning surface is required at all crossing vehicle locations and shall conform to Federal Color No. 33538 as shown in SAE AMS-STD-595A (Table IV of Federal Standard No. 595A). CBC Ch. 11B-705.1.1.3 Color and Contrast.
- F. Truncated dome pattern in-line, not staggered.

## **2.02 TACTILE AND DETECTABLE WARNING DEVICES**

- A. Plastic Tactile and Detectable Warning Tiles: ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes, integral radius cut lines on back face of tile; with factory-applied removable protective sheeting.
  - 1. Material Properties:
    - a. Water Absorption: 0.20 percent, maximum, when tested in accordance with ASTM D570.
    - b. Slip Resistance: 0.50 minimum dry static coefficient of friction, when tested in accordance with ASTM D2047.
    - c. Compressive Strength: 25,000 pounds per square inch, minimum, when tested in accordance with ASTM D695.
    - d. Tensile Strength: 10,000 pounds per square inch, minimum, when tested in accordance with ASTM D638.
    - e. Flexural Strength: 25,000 pounds per square inch minimum, when tested in accordance with ASTM D790.
    - f. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, or antifreeze, when tested in accordance with ASTM D543.
    - g. Abrasion Resistance: 300, minimum, when tested in accordance with ASTM C501.
    - h. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84.
    - i. Accelerated Weathering: Delta-E of less than 5.0 at 2,000 hours exposure, when tested in accordance with ASTM G155.
    - j. Adhesion: No delamination of tile prior to board failure in a temperature range of 20 to 180 degrees F, when tested in accordance with ASTM C903.
    - k. Loading: No damage when tested according to AASHTO LRFD test method HS20.
    - l. Salt and Spray Performance: No deterioration or other defect after 200 hours of exposure, when tested in accordance with ASTM B117.
  - 2. Asphalt Installation Method: Surface applied.

3. Concrete Installation Method: Cast in place.
4. Shape: Rectangular.
5. Dimensions: 36 inches by 48 inches, nominal. Other sizes may be indicated on Drawings.
6. Pattern: In-line pattern of truncated domes complying with ADA Standards.
7. Edge: ADA Standards compliant bevel.
8. Joint: Butt.
9. Color: SAE AMS-STD-595, Table IV, Federal Yellow No. 33538.
10. At Asphalt Application Basis of Design Product: SSTD Traditional Mat System as manufactured by Safety Step TD; [www.safetysteptd.com](http://www.safetysteptd.com), or approved equal.
11. Surface Applied Products:
  - a. Access Tile, a brand of Access Products, Inc; Surface Applied Tile: [www.accesstile.com/#sle](http://www.accesstile.com/#sle).
  - b. ADA Solutions, a division of SureWerx USA; Surface Applied System: [www.adatile.com/#sle](http://www.adatile.com/#sle).
  - c. Detectable Warning Systems, Inc.; redimat (Surface Applied): [detectable-warning.com](http://detectable-warning.com).
  - d. Safety StepTD, Inc.; SSTD-Traditional Mat System: [www.safetystepTD.com](http://www.safetystepTD.com).
  - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
12. At Flush Concrete Application Basis of Design Product: Armor-Tile as manufactured by Engineered Plastics, or approved equal.
13. Concrete Recessed/Flush Products:
  - a. Access Tile, a brand of Access Products, Inc; Cast in Place Replaceable Tactile Warning Tile: [www.accesstile.com/#sle](http://www.accesstile.com/#sle).
  - b. ADA Solutions, a division of SureWerx USA; Cast in Place Replaceable (Wet-Set): [www.adatile.com/#sle](http://www.adatile.com/#sle).
  - c. Armor Tile by Engineered Plastics Inc.; Vitrified Polymer Composite (VPC) Cast In Place Detectable/Tactile Warning Surface Tile: [armor-tile.com](http://armor-tile.com).
  - d. Detectable Warning Systems, Inc.; alertcast (Replaceable Cast-in-Place): [detectable-warning.com](http://detectable-warning.com).
  - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 ACCESSORIES**

- A. Fasteners: ASTM A666, Type 304 stainless steel
  1. Type: Countersunk, color matched composite sleeve anchors
  2. Size: 1/4 inch diameter and 1-1/2 inches long.
- B. Adhesive: Type recommended and approved by surfacing tile manufacturer.
- C. Sealant: Elastomeric sealant of color to match adjacent surfaces; approved by surfacing tile manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. When installation location is near site boundary or property line, verify required location using property survey.
- B. Verify that work area is ready to receive work:
  - 1. Examine work area with installer present.
  - 2. If existing conditions are not as required to properly complete the work of this section, notify Architect.
  - 3. Do not proceed with installation until deficiencies in existing conditions have been corrected.
- C. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

### **3.02 INSTALLATION, GENERAL**

- A. Install in accordance with manufacturer's written instructions.
  - 1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
  - 2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.
- B. Field Adjustment:
  - 1. Cut units to size and configuration shown on drawings. (If required)
  - 2. Do not cut plastic tiles to less than 9 inches wide in any direction.
  - 3. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
  - 4. Orient so dome pattern is aligned with the direction of ramp.
  - 5. Align truncated dome pattern between adjacent units.
- C. Install units fully seated to substrate, square to straight edges and flat to required slope.
- D. Align units so that tops of adjacent units are flush and joints between units are uniform in width.

### **3.03 INSTALLATION, CAST IN PLACE PLASTIC TILES**

- A. Concrete:
  - 1. See Section 32 13 13 - Site Concrete.
  - 2. Slump: 4 to 7 percent.
- B. When installing multiple adjacent units, leave a 3/16 inch gap between units to allow for expansion.
- C. Tamp and vibrate units as recommended by manufacturer.
- D. Place and position weights on units while concrete cures as recommended by manufacturer. Ensure no voids or air pockets exist between top surface of concrete and underside of units.

### **3.04 INSTALLATION, SURFACE APPLIED PLASTIC TILES**

- A. Cure concrete surfaces for a minimum of 4 days before installing units.

- B. Verify substrate is clean and dry; free of voids, projections and loose material. Remove dust, oil, grease, curing compounds, sealers and other substances that may interfere with adhesive bond or sealant adhesion.
- C. Mechanically roughen surface as required to remove contaminants and prepare surface for adhesive and sealant application.
- D. When installing multiple adjacent units, leave a 1/8 inch gap between tiles to allow for expansion.
- E. Drill fastener holes straight, true and to depth recommended by manufacturer.
- F. Apply adhesive to back of unit as recommended by manufacturer.
- G. Mechanically fasten to substrate. Avoid striking or damaging the unit itself during installation.
- H. Apply sealant to edges in cove profile.

### **3.05 CLEANING PLASTIC UNITS**

- A. Remove protective plastic sheeting within 24 hours of installation.
- B. Remove excess sealant or adhesive from joints and edges.
- C. Clean four days prior to date of scheduled inspection.

### **3.06 PROTECTION**

- A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.
- B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

## **END OF SECTION**

## **SECTION 32 31 13 CHAIN LINK FENCES AND GATES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Posts, rails, and frames.
- B. Wire fabric.
- C. Concrete.
- D. Manual gates with related hardware.
- E. Accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Steel tube gate frames.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Integration of hollow metal doors as gates
- C. Section 08 71 00 - Door Hardware: Gate locking device.
- D. Section 31 23 16 - Excavation: Excavation for footings.
- E. Section 32 13 13 - Site Concrete: Concrete anchorage for posts.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- E. ASTM F626 - Standard Specification for Fence Fittings.
- F. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
- G. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- H. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
- I. BHMA A156.3 - Exit Devices.
- J. CLFMI CLF 2445 - Product Manual - Drawings.
- K. CLFMI CLF-FIG0111 - Field Inspection Guide.
- L. CLFMI CLF-PM0610 - Product Manual.
- M. CLFMI CLF-SFR0111 - Security Fencing Recommendations.



- N. CLFMI WLG 2445 - Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing.
- O. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric).

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.
- D. Samples: Submit two samples of fence fabric, slat infill, 12 inch by 12 inch in size illustrating construction and colored finish.
- E. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates, and accessories.
- F. Manufacturer's Qualification Statement.
- G. Fence Installer Qualification Statement.
- H. Field Inspection Records: Provide installation inspection records that include post settings, framework, fabric, barbed wire, fittings and accessories, gates, and workmanship.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

#### **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for gate hardware.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Provide fences and gates meeting life safety and accessibility requirements of California Building Code (CBC) Title 24, Part 2, Chapters 10 and 11B; and ADA Standards, per latest amendments.
  - 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 and 11B-206.5.
  - 2. Gate Hardware: Meet the requirements of CBC 11B-206.5 and 11B-404.2.9.
    - a. Latch: Latch, including padlock eye as integral part of latch, mounted 40 inches above finish grade. Comply with California Fire Code.

- b. Hardware shall comply with local Fire Authority, California Building Code (CBC) Title 24, Section 1010.1.9.1, and California Fire Code (CFC) Section 503.5.2.
  - c. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2 inch 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).
  - d. Hand activated opening hardware, handles, pulls, latches, locks, and other operating devices for and accessible gate shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate. CBC Section 11B-404.2.7 and 11B-309.4.
- 3. Swing doors and gate surfaces within 10 inches 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 inch 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
  - 4. The bottom of the gate shall be within 3 inches of the finish surface of the path of travel. The maximum effort to operate a gate shall not exceed 5 lbf. CBC Section 11B-404.2.9.

## **2.02 MANUFACTURERS**

- A. Chain Link Fences and Gates:
  - 1. Master-Halco, Inc: [www.masterhalco.com/#sle](http://www.masterhalco.com/#sle).
  - 2. Merchants Metals: [www.merchantsmetals.com/#sle](http://www.merchantsmetals.com/#sle).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 COMPONENTS**

- A. Sizes to be determined by fencing manufacturer for wind load of fencing with "tennis court" windscreen and design wind speed of 105 mph. Comply with CLFMI WLG 2445. The following sizes and those listed on the Drawings are minimum.
- B. Line Posts at 6 ft. height: 2.88 inch outside diameter pipe, schedule 40, Group 1A.
- C. Line Posts at 8 ft. height: 3.5 inch outside diameter pipe, schedule 40, Group 1A.
- D. Corner and Terminal Posts, at 6 ft. height: 2.88 inch outside diameter pipe, schedule 40, Group 1A.
- E. Corner and Terminal Posts, at 8 ft. height: 3.5 inch outside diameter pipe, schedule 40, Group 1A.
- F. Gate Posts, at 8 ft. height: 4-1/2 inch outside diameter pipe, schedule 40, Group 1A.
  - 1. Provide posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths.
    - a. Comply with CLFMI CLF 2445 published standards.
- G. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
- H. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.
- I. Gate Frame: 1.9 inch diameter for welded fabrication.

1. Meet the requirements of ASTM F900.
  - a. Gate frame to be of welded construction.
    - 1) Weld areas to be protected with zinc-rich paint per ASTM A780/A780M.
  - b. The gate frame members are to be spaced no greater than 8 feet apart horizontally or vertically.
2. Pedestrian Gate: Maximum gate leaf width 4'-0" and minimum gate width of 36 inches along path of travel and means of egress.
3. Fabricate perimeter frames of gates from metal and finish to match fence framework. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories with additional horizontal and vertical members to insure proper gate operation.
4. Use same fabric as for fence, installed with stretcher bars and bands at vertical edges and at top and bottom edges.
5. Install diagonal cross bracing consisting of 5/16 inch diameter truss rods with drop forged steel turnbuckles, per ASTM F626, where necessary to insure frame rigidity without sag or twist.
6. Vehicle Rolling/Sliding Gates: Meet the requirements of ASTM F900.
  - a. Gates over 6 feet high, fabricate from Group 1A materials, 50 ksi.
- J. Fabric: 1-3/4 inch diamond mesh interwoven wire, 11 gauge, 0.1205 inch thick, top selvage knuckle end closed, bottom selvage knuckle end closed.
- K. Tension Wire: 6 gauge, 0.1920 inch thick steel, single strand.
- L. Tension Bar: 3/16 by 3/4 inch thick steel.
- M. Tension Band: 12 gauge, 0.105 inch thick steel.
- N. Tension Strap: 12 gauge, 0.105 inch thick steel.
- O. Tie Wire: Aluminum alloy steel wire.
- P. Infill Panel:
  1. Perforated Panels: G90 Galvanized steel panel, staggered perforated pattern.
    - a. Basis of Design: McNichols Company HS Item Number 1431141641, 16 gage, 3/16 inch holes and 1/4 inch spacing, or equal.
- Q. Woven Wire Mesh: Heavy duty.
  1. Material: Carbon Steel, Cold Rolled, Woven, I3I3 Crimp Style.
  2. Wire Size: 10 gauge, 0.135 inch.
  3. Mesh Opening Size: 1 inch square shape.
  4. Mesh Weave: Plain weave, inter-crimped.
  5. Basis of Design: ITEM 3692900041 - 48" x 120" as manufactured by McNichols, [www.mcnichols.com](http://www.mcnichols.com), or equal.

## 2.04 MATERIALS

- A. Posts, Rails, and Frames:

1. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; zinc coating complying with ASTM F1043 and ASTM F1083.
  2. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
  3. Comply with CLFMI CLF-PM0610.
- B. Wire Fabric:
1. ASTM A392 zinc coated steel chain link fabric.
  2. Comply with CLFMI CLF-PM0610.
- C. Concrete:
1. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3 inch slump; 3/4 inch nominal size aggregate.

## **2.05 MANUAL GATES AND RELATED HARDWARE**

- A. See Section 08 06 71 - Door Hardware Schedule for specific hardware components.
- B. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp.
- C. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.
1. Hinges: Hot dip galvanized pressed steel or malleable iron, structurally capable of supporting gate leaf and allow opening and closing without binding.
  2. Non-lift-off type hinge design to permit gate to swing 180 degrees.
- D. Hinges: Finished to match fence components.
1. Closing: Self.
- E. Latches: Finished to match fence components.
- F. Gate Holdback: Provide galvanized gate hold back keeper for each gate leaf over 60 inches wide.
1. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

## **2.06 LIGHT-DUTY ARCHITECTURAL HARDWARE**

- A. Exit Devices: Aluminum, 36 inches (914 mm) wide.
1. Performance Criteria: Comply with BHMA A156.3, Grade 1.
  2. Provide strike of type recommended by manufacturer for application indicated.
- B. Mechanical Latches: Steel latch, with mounting bracket for a nominal 2 inches (51 mm) diameter pipe post frame.
1. Finish: Galvanized.
  2. Forked type with welded U-bracket on both sides. Capable of retaining gate in closed position and have provision for padlock.

- a. Latch shall permit operation from either side of gate.
- C. Roller Assembly: Steel chassis assembly with permanently-lubricated and sealed roller bearings.
  - 1. Weight Rating: 1,000 pound (454 kg).
  - 2. Shaft: 1 inch diameter hardened steel shaft.
  - 3. Roller: Polymer casting, secured to shaft with nylon locknut.
  - 4. Mounting to Round Fence Post: U-bolts.
  - 5. Finish: Galvanized.
- D. Hinge Set: Self-closing, for top and bottom support of swinging gate.
  - 1. Swing Direction: One way.
  - 2. Finish: Powder Coat, color as selected by Architect.
  - 3. Products:
    - a. Loconix; Mammoth 180: [www.loconix.com](http://www.loconix.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.07 ACCESSORIES**

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Other Fencing Accessories: Provide other pressed steel or cast iron accessories and fencing items necessary for a complete installation as required by Project conditions and as recommended by fencing manufacturer.

## **2.08 FINISHES**

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.
- B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
- C. Accessories: Same finish as framing.
- D. Color(s): To be selected by Architect from manufacturer's standard range.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

### **3.02 PREPARATION**

- A. Removal: Obstructions or debris.
- B. Excavation: Excavate line post holes as indicated on Drawings.
  - 1. Provide footing depths as indicated on Drawings and conforming to CLFMI published standards, based on fabric height, wind pressure and soil types.

### 3.03 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Place fabric on outside of posts and rails.
- C. Set intermediate posts plumb , in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- D. Line Post Footing Depth Below Finish Grade: ASTM F567.
- E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- F. Gates: Install gates plumb, level and secure. Install as recommended by fence manufacturer. Adjust hardware for smooth operation and lubricate as required.
- G. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- H. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
  - 1. Connect ends with sleeves forming a rigid connection, allow for expansion and contraction.
- I. Install center brace rail on corner gate leaves.
  - 1. Center Rails: Install mid rails between line posts and attach to post using rail end or line rail clamps.
- J. Bottom Rails: Install bottom rails between posts and attach to post using rail end or line rail clamps
- K. Do not stretch fabric until concrete foundation has cured 28 days.
- L. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
  - 1. Tighten hardware, fasteners, and accessories.
  - 2. Bend ends of tie wires to preclude snagging.
- M. Position bottom of fabric 2 inches above finished grade.
- N. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- O. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- P. Do not attach the hinged side of gate to building wall; provide gate posts.
- Q. Install hardware and gate with fabric to match fence.
- R. Install gate locking device specified in Section 08 71 00.
- S. Peen all bolts upon installation.
  - 1. Fastening: Fasten all fence and gate hardware secured in place by peening or welding to allow proper operation of components, but to prevent disassembly of fencing or removal of gates.
    - a. Coat fastenings, hardware, and all other connections, which have been peened or welded, with a heated re-galvanizing alloy.
- T. Perform three random field inspections confirming proper installation.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.
- C. Do not infringe on adjacent property lines.

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- C. Post Settings: Randomly inspect three locations against design for:
  - 1. Hole diameter.
  - 2. Hole depth.
  - 3. Hole spacing.
- D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- E. Gates: Inspect for level, plumb, and alignment.
- F. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

### **3.06 CLEANING**

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.
- E. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.
- F. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

### **3.07 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

## **END OF SECTION**

**SECTION 32 31 19**  
**DECORATIVE METAL FENCES AND GATES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Decorative steel fences.
- B. Decorative aluminum fences.
- C. Excavation for post bases; concrete foundation for posts and center drop for gates.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Custom fabricated metal components.
- B. Section 31 23 16 - Excavation: Excavation for footings.
- C. Section 32 13 13 - Concrete Paving: : Concrete anchorage for posts.
- D. Section 32 3113 - Chain Link Fences and Gates.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
- C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- E. ASTM D523 - Standard Test Method for Specular Gloss.
- F. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints.
- G. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- H. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- I. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
- J. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- K. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test.
- L. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.
- M. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).
- P. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.



#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings:
  - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
- D. Installer's Qualification Statement.
- E. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.
- F. Field Inspection Records: Provide installation inspection records that include post settings, framework, fittings and accessories, gates, and workmanship.
- G. Manufacturer's Warranty.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.
- C. Fabricator's Qualifications: Fabricator of light structural steel framing members and other miscellaneous metal fabrications of structural character shall have a minimum 5 years experience fabricating similar fences and gates and shall be approved by the Building Official in accordance with applicable Code provisions.
- D. Welder's Qualifications: Welding shall be performed by certified welders qualified in accordance with procedures specified in applicable referenced AWS standard, using materials, procedures and equipment of the type required for the Work. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- E. Coordination: Provide templates and sleeves for incorporation of embedded items into the work specified elsewhere herein or in other Sections.
- F. Field-Verified Dimensions: Prior to fabrication, field verify dimensions and details of construction. Immediately report variances in writing to Architect.

### **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide ten year warranty for finish.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS:**

- A. Provide fences and gates meeting life safety and accessibility requirements of California Building Code (CBC) Title 24, Part 2, Chapters 10 and 11B; and ADA Standards, per latest amendments.
  - 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 and 11B-206.5.
  - 2. Gate Hardware: Meet the requirements of CBC 11B-206.5 and 11B-404.2.9.
    - a. Latch: Latch, including padlock eye as integral part of latch, mounted 40 inches above finish grade. Comply with California Fire Code.
    - b. Hardware shall comply with local Fire Authority, California Building Code (CBC) Title 24, Section 1010.2, and California Fire Code (CFC) Section 503.5.2.
    - c. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2 inch 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).
    - d. Hand activated opening hardware, handles, pulls, latches, locks, and other operating devices for and accessible gate shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate. CBC Section 11B-404.2.7 and 11B-309.4.
  - 3. Swing doors and gate surfaces within 10 inches 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 inch 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
  - 4. The bottom of the gate shall be within 3 inches of the finish surface of the path of travel. The maximum effort to operate a gate shall not exceed 5 lbf. CBC Section 11B-404.2.9.

### **2.02 MANUFACTURERS**

- A. Decorative Metal Fences and Gates:
  - 1. Ametco Manufacturing Corporation: [www.ametco.com](http://www.ametco.com).
  - 2. Ameristar Perimeter Security, USA: [www.ameristarfence.com](http://www.ameristarfence.com).

3. Grating Pacific, Inc.: [www.gratingpacific.com](http://www.gratingpacific.com).
4. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 FENCES**

- A. Fences: Complete shop-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with specified coating, and having the following performance characteristics:
  1. Capable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.
- B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
  1. Total Coating Thickness: 2 mils, minimum.
  2. Color: As shown on drawings.
  3. Coating Performance: Comply with general requirements of ASTM F2408.
    - a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
    - b. Corrosion Resistance: ASTM B117, ASTM D714 and ASTM D1654; 1/8 inch coating loss or medium No.8 blisters after 1,500 hours.
    - c. Impact Resistance: ASTM D2794; 60 inch pounds.
    - d. Weathering Resistance: ASTM D523, ASTM D822/D822M and ASTM D2244; less than 60 percent loss of gloss.
- C. Aluminum: ASTM B221.
  1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
  2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
  3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.
- D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
  1. Tamper-proof security bolts.
  2. Self-drilling hex-head screws.

## **2.04 MECHANICALLY FASTENED STEEL FENCE**

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.
- B. Basis of Design Product: Montage II® - Heavy Industrial Steel Ornamental Fence System – Fusion Welded and Rackable with 3-Rail Majestic Pickets as manufactured by Ameristar Perimeter Security, USA, or equal.
- C. Fence Panels: Mechanically fastened with internal reinforcement and tamperproof fasteners; 8 feet high by 6 feet long.
  1. Panel Style: Three rail.
  2. Panel Strength: Capable of supporting 600 pound load applied at midspan without deflection.
  3. Attach panels to posts with manufacturer's standard panel brackets.

- D. Posts: Steel tube.
  - 1. Size: 4 inches square by 12 gauge, 0.1094 inch, with manufacturer's standard cap.
  - 2. Post Cap: Ball.
- E. Rails: Manufacturer's standard, double-wall steel channel; 1-3/4 inch square by 14 gauge, 0.0747 inch with pre-punched picket holes.
  - 1. Picket Retaining Rods: 1/8 inch galvanized steel.
  - 2. Picket-to-Rail Intersection Seals: PVC grommets.
- F. Pickets: Steel tube.
  - 1. Spacing: 4.175 inch on center.
  - 2. Size: 3/4 inch square by 11 gage, 0.1233 inch.
  - 3. Style: Pickets with finial extend above top rail.
  - 4. Finial: Spear point.
- G. Flexibility: Capable of following variable slope of up to 1:4.
- H. Color: Black.

## **2.05 ALUMINUM FENCE**

- A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.
- B. Fence Panels: 8 feet high by 8 feet long.
  - 1. Panel Style: Three rail.
  - 2. Panel Strength: Capable of supporting 270 pounds minimum load applied at midspan without deflection.
  - 3. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
- C. Posts: Aluminum extrusions; 2-1/2 inches square.
- D. Rails: Extruded aluminum channels.
  - 1. Rail Inner Slide: Fully inserted into the rail outer channel to form the raceway for the internal retaining rod. Grommets shall be inserted into the pre-punched holes in the rails, and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal raceway of the two-part ForeRunner rails. (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.
  - 2. Enclosed Retaining Rod: 1/8 inch diameter galvanized steel with variable pitch connection system for high angle racking and elimination of external fasteners.
- E. Pickets: Extruded aluminum tubes.
  - 1. Size: 1-1/4 inch square.
  - 2. Style: Pickets with finial extend above top rail.
- F. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.

- G. Gates: Fabricated using 1.75" sq. reinforced ForeRunner rail material, 2" sq. x .250" gate ends, and 1" sq. x .125" pickets. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall be joined by welding.
- H. Accessories: Aluminum castings, extrusions, and cold-formed strips; factory finished to match fence.
  - 1. Flat post cap.
- I. Flexibility: Capable of following variable slope of up to 1:4.
- J. Color: Manufacturer's standard, factory applied Black.
- K. Products:
  - 1. Basis of Design Product: Echelon II® - Heavy Industrial Aluminum Ornamental Fence System – Internally Secured as manufactured by Ameristar Perimeter Security, USA, or equal.
  - 2. Alumi-Guard, Ornamental Picket Fences; Premier: [www.alumi-guard.com/#sle](http://www.alumi-guard.com/#sle).
  - 3. Ameristar Perimeter Security, USA; Echelon II: [www.ameristarfence.com/#sle](http://www.ameristarfence.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- L. Decorative Aluminum Post-and-Rail Fence and Swinging Gates:
  - 1. Style: Three-rail.
  - 2. Posts: Aluminum extrusions; 4 inch square.
  - 3. Color: Manufacturer's standard, factory applied Black.
- M. Decorative Aluminum Cantilever Gates:
  - 1. Gate Panels: Manufacturer's standard decorative aluminum fence panels.
  - 2. Posts: Aluminum extrusions; 2 inches square.
  - 3. Rails and Frame: Welded aluminum extrusions; 2 inches by 3 inches.
  - 4. Hardware:
    - a. Latch: Manufacturer's standard mechanism; factory finished galvanized steel.
    - b. Truck Assembly: Manufacturer's standard, self-aligning, wheeled truck assembly supporting weight of gate plus 2,000 pound reaction load; provide number of truck assemblies per gate recommended by manufacturer.
    - c. Guide Wheel Assembly: Manufacturer's standard, adjustable, dual wheel assembly; provide number of guide wheels per gate recommended by manufacturer.
  - 5. Operation: Automatic.
  - 6. Operator: Comply with UL 325, Class III and ASTM F2200.
  - 7. Manufacturer's standard electric operating system with integral controls, sensors, remote latching and unlatching, safety devices, communication devices, and emergency vehicle access.
  - 8. Provide a separate clearly marked pedestrian access for each entrance with automated gate.
  - 9. Color: Manufacturer's standard, factory applied Black.

## 2.06 SPECIALITY HARDWARE

- A. Pedestrian Gate Hardware: Provide non-lift-off type and 180 degree opening hinges, latches, drop bolts, and other hardware required.
  - 1. See Section 08 71 00 - Door Hardware for specific item requirements.
  - 2. Hardware to comply with local Fire Authority, California Building Code (CBC) Title 24 section 1013; and California Fire Code (CFC) section 503.5.2.
    - a. Hardware to comply with CBC Section 11B-309.4.
  - 3. Double and Single Leaf Gates: Provide with mechanisms for padlocking gates in open position.
  - 4. Double Gates Not in Path of Travel or Egress: Provide gate stops set in concrete to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
  - 5. Gates across an exit to a public way or to a safe dispersal area shall have panic hardware. No padlocks or cane bolts shall be allowed.
- B. Gate Hardware, Not on on Path of Travel: <>
  - 1. Hinges:
    - a. Size and type as determined by manufacturer.
    - b. Provide 2 hinges for each leaf up to 6 feet high and 1 additional hinge for each additional 24 inches in height or fraction thereof.
  - 2. Latch: 3/4 inch diameter slide bolt to accommodate padlock.
  - 3. For double gates provide padlockable, 5/8 inch diameter center cane bolt assembly and strike.
- C. Hinges: Finished to match fence components.
  - 1. Closing: Self.
  - 2. Mechanism: Hydraulic.
  - 3. Material: Steel.
  - 4. Mounting: External.
  - 5. Brackets: Round.
  - 6. Bearings: Plain.
  - 7. Products:
    - a. Loconix; Mammoth: [www.loconix.com](http://www.loconix.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.07 FABRICATION

- A. Metal Fences, Gates and Components: Fabricated of galvanized steel construction, all welded with welds ground smooth. Provide steel anchors for securing into adjoining construction. Weld anchors to frames not more than 12 inches from both top and bottom and space anchors not more than 24 inches apart.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Field Inspection of Fabricated Products: Prior to installation, inspect products for damage and verify markings and dimensions against reviewed submittals.
- D. Coordination: Coordinate fence and gate Work with Work specified in other Sections so that related Work shall be accurately and properly joined. Furnish templates for exact location of items to be embedded in concrete or masonry.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Obtain Architect's review prior to site cutting or making adjustments not indicated on Drawings and reviewed shop drawings.
- C. Clean and strip site primed steel items to bare metal where site welding is necessary.
- D. Make provision for erection loads with temporary bracing. Keep work in alignment.
- E. Provide items required to be cast into concrete with setting templates. Coordinate placement with adjacent Work.
- F. Clean and prime field welds. Touch up galvanized steel with cold repair compound.

### **3.03 INSTALLATION**

- A. Installation, General: Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Install in accordance with fabricator's instructions.
- C. Set fence posts in accordance with the approved spacing.
- D. Perform field welding in accordance with AWS D1.1/D1.1M. All welds ground smooth.
- E. When cutting rails immediately seal the exposed surfaces by:
  - 1. Removing metal shavings from cut area.
  - 2. Apply zinc-rich primer or galvanizing patch compound to thoroughly cover cut edge and drilled hole; allow to dry.
  - 3. Apply two coats of custom finish spray paint matching fence color.
- F. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
  - 1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.
  - 2. Identify the necessary hardware required for the application on the manufacturer's gate drawings.
  - 3. Provide gate hardware as specified for the gate and install per manufacturer's recommendations

- G. Excavate post holes in accordance with Section 31 23 16.
- H. Install posts in concrete by means of pipe sleeve inserts set and anchored in concrete. Fill annular space between pipe posts and sleeve inserts with grouting compound.
- I. Set line posts in concrete footing.
  - 1. Diameter: 12 inch minimum to maintain 3 inch concrete cover. Unless otherwise indicated or detailed on Drawings.
  - 2. Provide 36 inches minimum embedment of posts up to 8'-0".
  - 3. Provide 6 inches minimum concrete beneath post bottom.
- J. Provide concrete center drop to footing depth and drop rod retainers at inactive leaf, at center of double gate openings.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From Indicated Position: 1 inch.
- C. Minimum Distance from Property Line: 6 inches.

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- C. Post Settings: Randomly inspect three locations against design for:
  - 1. Hole diameter.
  - 2. Hole depth.
  - 3. Hole spacing.
- D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- E. Gates: Inspect for level, plumb, and alignment.
- F. Workmanship: Verify neat installation free of defects.

### **3.06 CLEANING**

- A. Leave immediate work area neat at end of work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Touch up scratched surfaces using visually materials recommended by manufacturer. Match touchup paint color to fence finish.
  - 1. Galvanized Touch-Up: Touch up surfaces immediately after installation, including field welding. Prepare surface and apply cold repair compound in compliance with the product manufacturer's instructions and recommendations.



- a. Material: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction. Provide finish coat to match galvanized finish.
- E. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

### **3.07 CLOSEOUT ACTIVITIES**

- A. Demonstrate proper operation of equipment to Owner's designated representative.
- B. Demonstration: Demonstrate operation of system to Owner's personnel.
  - 1. Use operation and maintenance data as reference during demonstration.
  - 2. Briefly describe function, operation, and maintenance of each component.

### **3.08 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

## **SECTION 32 33 13 SITE BICYCLE RACKS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Exterior bicycle racks. PC-1

#### **1.02 RELATED REQUIREMENTS**

- A. Section 32 13 13 - Site Concrete: Mounting surface for bicycle racks.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

#### **1.05 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide products by the same manufacturer.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least ten years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Handle racks with sufficient care to prevent scratches and other damage to the finish.

#### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

- B. Manufacturer Warranty: Provide three-year manufacturer warranty for material and/or workmanship. Complete forms in Owner's name and register with manufacturer.
- C. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Exterior Bicycle Racks:
  - 1. Belson Outdoors: [www.belson.com](http://www.belson.com).
  - 2. Columbia Cascade Company: [www.timberform.com](http://www.timberform.com).
  - 3. Dero: [www.dero.com](http://www.dero.com).
  - 4. Highland Products Group, LLC: [www.indoorbikeracks.net](http://www.indoorbikeracks.net).
  - 5. Huntco Supply, LLC: [www.huntco.com](http://www.huntco.com).
  - 6. Landscape Forms, Inc.: [www.landscapeforms.com](http://www.landscapeforms.com).
  - 7. MADRAX, a brand of Graber Manufacturing, Inc: [www.madrax.com/#sle](http://www.madrax.com/#sle).
  - 8. Neenah Foundry, a division of Neenah Enterprises, Inc: [www.nfco.com](http://www.nfco.com).
  - 9. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 BICYCLE RACKS**

- A. Exterior Bicycle Racks: Device allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
  - 1. Style: Decorative.
  - 2. Mounting, Ground: In-ground anchor.
  - 3. Finish: Powder coat, maintenance-free and weather-resistant.
  - 4. FGP Finish on upper frame: Clear anodized.
  - 5. FGP Finish on cover plates: Dark grey anodized.
  - 6. Color: As selected by Architect from manufacturer's custom range.
  - 7. Accessories: In-ground grout cover.
- B. Materials:
  - 1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine surfaces to receive bicycle racks.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.
- C. Do not begin installation until unsatisfactory conditions are corrected.

### **3.02 PREPARATION**

- A. Ensure surfaces to receive bicycle racks are clean, flat, and level.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install level, plumb, square, and correctly located as indicated on drawings.
- C. In-Ground Anchor Installation:
  - 1. Prepare holes in size according to manufacturer's instructions.
  - 2. Place anchoring bolts through the holes in pipe.
  - 3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch from the ground.
  - 4. Place concrete.
  - 5. Level rack before concrete sets.
  - 6. Support until dry.
- D. Post-Installed Anchors: Comply with ICC-ES AC308.
- E. Freestanding Installation: Place in location indicated on drawings.

### **3.04 CLEANING**

- A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 32 84 00**  
**PLANTING IRRIGATION**

**PART 1 - GENERAL**

**1.01 GENERAL CONDITIONS**

- A. Provide all labor, materials, tools, transportation, equipment and incidentals necessary to perform the work as indicated on the Irrigation Plans and as herein specified.

**1.02 SCOPE OF WORK**

- A. Irrigation materials and equipment.
- B. Installation standards.
- C. System location and layout.
- D. Excavation and backfill.
- E. Installation of pipe, equipment, and appurtenances.
- F. Water flow meters.
- G. Field quality control – Coverage Tests.
- H. Plant establishment period.
- I. Clean up.

**1.03 RELATED SECTIONS**

- A. Related work specified elsewhere:
  - 1. 32 90 00 – Planting

**1.04 REFERENCES**

- A. The Standard Specifications for Public Works Construction, “Greenbook”, latest edition, is reference as if herein contained and the contractor shall keep a copy at the project site. These Specifications shall supersede conflicts with information given in the “Greenbook”, unless otherwise determined by the Owner or their designated representative.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A53                      Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - 2. ASTM D1557                Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2700 kN-m/m<sup>3</sup>))
  - 3. ASTM D1784                Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
  - 4. ASTM D1785                Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
  - 5. ASTM D2241                Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)

- 6. ASTM D2464                      Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- 7. ASTM D2466                      Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- 8. ASTM D2564                      Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
- C. California Code of Regulations, Title 24:
  - 1. Part 3 California Electrical Code
- D. Underwriters Laboratories Inc. (UL):
  - 1. UL 651 Schedule 40 and 80 Rigid PVC Conduit.

#### 1.05 VERIFICATION OF DIMENSIONS

- A. Dimensions are approximate, before proceeding with any work, Contractor shall verify all dimension and shall immediately inform the L.A. and owner of any discrepancies between the drawings and/or specifications and actual field conditions. No work shall be done in any area where there is such a discrepancy until approval has been given by L.A. and owner. Any work done without notification and prior approval will be the sole responsibility of the Contractor to remedy as required by L.A. and Owner.

#### 1.06 SUBMITTALS

- A. Contractor to supply submittals per contract documents, the following are required to be submitted to the Owners Representative prior to start of work.
- B. Existing Static water pressure/ Water service size verification:  
 Static water pressure on site shall be recorded with an accurate liquid filled gauge capable of measuring 0-200 PSI (Winters PFQ806LF or equal). Measurements shall be taken as early as possible per available source and at a time no other distribution devices are actively running. Contractor to document readings in writing on Contractors form that list time & date, reading in PSI, location, and type of gauge used in addition to date stamped photographs of readings. Contractor to document all points of service including both potable and recycled. Final results shall be submitted to the Owners representative prior to purchase of equipment.
- C. Materials List:
  - 1. Complete material list shall be submitted prior to performing any work. Catalog data and full descriptive literature must be submitted whenever the use of the item is different than those specified is requested. Notarized certificate must be submitted by plastic pipe and fitting manufacturer indicating that material complies with specifications, unless material has been previously approved.
  - 2. Material list shall be submitted using the following format (double spaced between each item):

<u>Item</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model</u>
1.	Pressure Pipe	Lasco	Sch. 40
2.	Lawn Head	Rainbird	1804-SAM-PRS
Etc.	Etc.	Etc.	Etc.

D. Record Drawings:

1. Record accurately on one set of contract drawings all changes in the work constituting departures from the original contract drawings daily including noting when work was done.
2. The changes and dimensions shall be recorded in a legible and workmanlike manner to the satisfaction of the Owners Representative. Prior to final inspection of work, submit record drawings to Owners Representative for approval.
3. Dimensions shall be from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Data to be shown on record drawing shall be recorded day to day as the project is being installed. All lettering on drawings shall be minimum 1/8 inch in size.
4. Show locations and depths of the following items:
  - a. Point of connection.
  - b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing)
  - c. Gate valves/ Isolation valves.
  - d. Sprinkler control valves.
  - e. Quick coupling valves.
  - f. Routing of control wires.
  - g. Related equipment (as may be directed).
5. Maintain record drawings on-site at all times. Upon completion of work, transfer all as-built information and dimensions to clean blackline prints for reproduction.

E. Operation and Maintenance Manual: Operation and Maintenance Data, for submittal requirements. As a minimum, provide operation and maintenance instructions for the following items:

1. Electric Remote-Control Valves (including master control valves);
2. Satellite Irrigation Controllers;
3. Water Flow Meters; and
4. Irrigation Controller Software.

## 1.07 QUALITY ASSURANCE

- A. The landscape irrigation system shall consist of a completely automatic, electrically-controlled bubbler, drip, and spray-irrigation system. The system shall be installed to provide complete coverage with minimum maintenance. The irrigation system shall be installed to prevent overspray onto walks and structures.
- B. The irrigation system shall avoid conflicts with plant materials, lighting standards, sign posts, architectural features, above and below ground utilities, and drainage system. Contractor responsible for coordination with other trades to verify acceptable locations to avoid conflicts.
- C. Irrigation piping layout is schematic, showing location of pipes and fittings close to landscape areas is not always possible graphically. All equipment shall be located inside the landscape areas.
- D. In some cases, Manufacturer standards/requirements may be in addition or supersede those items shown via the plans and details. It is the Contractors responsibility to review and verify

with the manufacturer all the required and up to date equipment and accessories are included in addition or in leu of items shown via the plans. At all times the Manufactures requirements shall take precedence and as the installation expert the Contractor shall be responsible for installing the most up to date and current equipment per the manufacturers requirements to ensure full compliance with guarantee, certification, and warrantee requirements as part of their bid.

- E. Plant establishment period is specified in Section 32 93 00 – Plants.

#### **1.08 SEQUENCING AND SCHEDULING**

- A. Contractor to coordinate layout and installation of irrigation sleeves, conduits, and piping under paved areas and other features prior to their construction.
- B. Coordinate installation of irrigation system with excavation of planting beds and backfilling of planting beds with topsoil. Refer to Section 32 90 00, Planting, for requirements. Typically, the irrigation system shall be installed after planting beds have been excavated and backfilled with topsoil.
- C. The irrigation system shall be installed and tested prior to installation of plant material. Coordinate layout and installation of irrigation system with location and installation of plant material to assure that there will be complete and uniform irrigation coverage of planting as indicated.
- D. Tree locations shall be staked in the field prior to installation of irrigation pipe and heads. Refer to the plant list on the Contract Drawings for plant setbacks and spacing requirements.

#### **1.09 EXISTING UTILITIES**

- A. Existing utilities and conditions: Prior to cutting into the soil, locate all cables, conduits, sewer lines, septic systems, and other utilities commonly encountered underground and take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, promptly notify the L.A. and Owner who will give direction. Proceed in the same manner if a rock layer or any other conditions encountered underground make changes advisable.
  - 1. Where investigation of subsurface conditions has been made by a qualified body in areas in which local materials may be obtained, the Contractor may request the use of such information but will be solely responsible for its verification and accuracy
  - 2. It is the Contractors sole responsibility to verify any located or demarked utilities via pot holing or other method prior to start of excavation. Failure to do so will result in all damages being the sole responsibility of the Contractor.

#### **1.10 INSPECTIONS**

- A. Inspections will be required for:
  - 1. Pressure test of irrigation main line.
  - 2. Coverage test.
  - 3. Manufacture certification, for warranty, verification of installation per manufacture requirements.



4. Final inspection/start of maintenance. Final inspection shall be performed by the Owners Representative and Landscape Architect
    - a. Final inspection shall include verification of complete installation per plans
    - b. All Sensors, gauges, grounding, and accessories must be installed and functioning/programed per manufacture requirements
    - c. Third party water audit of system per MWELO requirements, Contractor shall be responsible for supplying water audit and results/ report to Owner's representative as completed by a Certified Landscape Irrigation Auditor(CLIA).
  5. Completion of maintenance and owners' Final acceptance.
- B. Inspection Requests:
1. Contractor shall notify the Owners Representative and Landscape Architect in advance for requesting all inspections as follows:

Pressure supply line installation and testing - 36 hours (1- 2 working days)

System layout - 36 hours (1- 2 working days)

Coverage Tests - 36 hours (1- 2 working days)

Final Inspection - 48 hours (2 working days)
  2. When inspections have been conducted by other approved personnel, the Contractor shall show evidence in writing of when and by whom these inspections were made including a signature of the referenced Inspector.
  3. No inspection will commence without "record" prints. In the event the Contractor calls for an inspection without up to date "record" prints, without completing previously noted corrections, or without preparing the system for inspection, the inspection will be canceled and the Contractor back charged for the direct costs of all Owners Representative time and consultant time lost.
- C. Closing in Uninspected Work:
1. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been inspected, tested, and approved by the Owners Representative.
  2. Any additional inspections required due to the Contractors actions, such as failing to have work inspected or covering it prior will- result in additional inspections charged by the current hourly rate of the Landscape Architect or Certified Irrigation designer/Auditor including travel time and expenses.
- D. Coverage Test and Adjustment:
1. When the sprinkler system is completed, Contractor shall perform a coverage test in the presence of the Owners Representative and the Landscape Architect to determine if the water coverage for planting areas is complete and adequate. This test shall be accomplished before any planting.
  2. Any adjustment required for proper coverage shall be the Contractors Responsibility, and shall include field adjustments and additions as needed to head layout as directed by the Landscape Architect. All additional cost associated with final system tuning and adjustments shall be the Contractors Responsibility.
- E. Hydrostatic Tests:

1. All pressure lines shall be tested under a hydrostatic pressure of 150 psi for a period of not less than two hours or per local governing regulation- whichever is greater.
  2. All hydrostatic tests shall be made in the presence of the Owners Representative. No pressure line shall be backfilled until it has been inspected, tested, and approved in writing.
- F. Contractor shall furnish necessary force pump and all other test equipment.

#### **1.11 TURNOVER ITEMS**

A. Controller Charts:

1. Record drawings must be approved by Owners representative before charts are prepared.
2. Provide one controller chart for each automatic controller. Chart shall show the area covered by controller.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. Chart shall be a blackline print with a different color used to show the area of coverage for each station.
5. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

B. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Owners Representative 10 calendar days prior to final inspection. The manuals shall describe the material installed.
2. Each complete, bound manual shall include the following information:
  - a. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
  - b. Complete operating and maintenance instructions for all equipment.
  - c. Spare parts lists and related manufacturer information for all equipment.

C. Equipment:

1. Supply as part of this contract the following items:
  - a. 4 additional sprinkler heads of each type and spray pattern shown.
  - b. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head involved.
  - c. 10 additional drip emitters of each type and flow rate shown.
  - d. 25' of each type of drip tubing per plan, and 6 of each fittings used.
  - e. Two keys for each automatic controller.

- D. Contractor to supply and verify with the Owners Representative what type of padlocks and keys are required for all enclosures that can be secured as part of their bid. Each locking mechanism must have 4 copies of the correct key for turnover to the Owners Representative. Depending on actual enclosures per plan this includes locks for gates, any needed chains/cables, and other security instruments for the protection of Irrigation equipment.

## **1.12 GUARANTEE**

### **A. General:**

The entire sprinkler system, including all work done under this contract, shall be guaranteed against all defects and fault of material and workmanship for a period of one (1) year following the filing of the Notice of Completion. All materials used shall carry a manufacturer's guarantee of one (1) year.

Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to the Owner within ten (10) calendar days of receipt of written notice from the Owners Representative. When the nature of the repairs as determined by the Owners Representative constitute an emergency (e.g. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owners Representative by the Contractor, all at no additional cost to the Owner.

### **B. Form of Guarantee: Guarantee shall be submitted on Contractors own letterhead as follows:**

FORM OF:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the complete irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications. We agree to repair or replace any defects in materials or workmanship which may develop during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. This shall include all defects and failures in workmanship and the results of such issues such as trench settling, erosion as caused by failures or defects, and including plant replacement. We shall make such repairs or replacements within 10 calendar days following written notification by the Owners Representative. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from the Owners Representative, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT: \_\_\_\_\_

LOCATION: \_\_\_\_\_

SIGNED: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

PHONE: \_\_\_\_\_

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. Materials and or equipment installed or furnished shall be new and in pristine condition. Materials that have faded, are dirty, or have been improperly stored will be rejected and shall be removed from the site and replaced at no expense to the Owner.
- B. All materials shall be stored per manufactures recommendation and protected from, weather, construction activities, and vandalism/theft.

### **2.02 PIPE**

- A. Pressure supply line from point of connection through backflow prevention unit shall be Type 'K' brass or copper pipe.
- B. Pressure supply lines 2-1/2 inches in diameter and up to 6 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC.
- C. Pressure supply lines 2 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC.
- D. Non-pressure lines shall be Schedule 40 solvent weld PVC.

### **2.03 COPPER PIPE AND FITTINGS**

- A. Copper pipe shall be Type 'K', hard tempered ASTM B 88 and fittings shall be wrought solder joint type in accordance with ANSI B16.22.
- B. Joints shall be soldered with silver solder, conforming to ASTM B206.

### **2.04 BRASS PIPE AND FITTINGS**

- A. Brass pipe shall be 85 percent red brass, ANSI, Schedule 40 screwed pipe.
- B. Fittings shall be medium brass, screwed 125-pound class.

### **2.05 GALVANIZED STEEL PIPE AND FITTINGS**

- A. All galvanized steel pipe shall be Schedule 40, threaded, coupled, and hot-dipped galvanized, and shall comply with the requirements of ASTM A 120-66 or ASTM A 53-67.
- B. All fittings for galvanized steel pipe shall be 150-pound rated galvanized malleable iron, banded pattern.
- C. Pipe sizes indicated on the drawings are nominal inside diameter, unless otherwise noted.

### **2.06 CONDUIT**

- A. Conduit: Provide rigid non-metallic conduit conforming to UL Standard No. 651 for rigid non-metallic conduit, such as Schedule 40 PVC conduit, unless otherwise indicated.

### **2.07 PLASTIC PIPE AND FITTINGS**

- A. All plastic pipe shall bear the following markings: manufacturer's name, nominal pipe size, schedule or class, type of material, pressure rating in psi, NSF seal of approval, and the date of extrusion.
- B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound.

- C. Rubber gasket PVC pipe, couplings, and fittings shall conform to ASTM D 1784 Type I, Grade I, 2,000-psi design stress. Couplings, rubber gaskets, and fittings shall be as approved by the pipe manufacturer.
- D. Ring-type rubber gasket couplings shall permit a 5-degree deflection of the pipe at each coupling (2-1/2 degree each side) without exfiltration or infiltration, cracking or breaking.
- E. All fittings shall be standard weight Schedule 40 and shall be injection molded of an improved PVC fitting compound. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated.
- F. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be nonhardening sealing compound compatible with plastics. Compound must not lubricate the joint.
- G. All threaded nipples shall be standard weight Schedule 80 with molded threads.
- H. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy.

## **2.08 BACKFLOW PREVENTION UNITS**

- A. The backflow prevention unit shall be as indicated on the drawings.

## **2.09 BACKFLOW PREVENTION ENCLOSURE**

- A. The backflow prevention device enclosure shall be as indicated on the drawings or approved equal. Install one for each backflow device.

## **2.10 BOOSTER PUMP**

- A. The Pump unit shall be as indicated on the drawings if required.

## **2.11 VALVES**

- A. Gate and Ball Valves:
  - 1. Ball valves 2 inches or smaller shall have screwed joints and brass bodies.
  - 2. All gate valves larger than 3 inches in diameter shall have 2-inch-square operating units and have an arrow cast in the metal indicating the direction of opening. Valves shall have iron body and be bronze mounted.
  - 3. All gate valves larger than 2 inches and up to 3 inches in diameter shall conform to (1) or (2) above.
  - 4. All gate valves shall have a minimum working pressure of not less than 150 psi and shall conform to AWWA standards.
- B. Quick Coupling Valves:
  - 1. Body of valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 3/4-inch female threads opening at base, with two-piece body. Construct valves to be operated only with a coupler, designed for that purpose. Coupler is inserted into valve and a positive, watertight connection shall be made between coupler and valve. Hinge cover shall be brass with a yellow rubber-like vinyl cover bonded to it.

C. Remote Control Valves:

1. Valves shall be spring-loaded, self-cleaning, packless diaphragm activated, of a normally closed type.

## **2.12 VALVE BOXES**

- A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.
- B. The valve box cover shall be secured with a hidden latch mechanism or bolts.
- C. The cover and box shall be capable of sustaining a load of 1,500 pounds.
- D. Valve box extensions shall be by the same manufacturer as the valve box.
- E. Gate valve boxes shall be round plastic boxes with bolt-down covers marked "GV," heat branded in 2" high characters; AMETEK or approved equal.
- F. Remote control valve boxes shall be rectangular plastic boxes with bolt-down covers marked "RCV"; and with the valve identification number heat branded in 2" high characters; AMETEK or approved equal.
- G. Colors of boxes shall be green unless otherwise called out by the plans.
- H. Valve boxes shall be sized to fit all equipment with ample room for operation and any required maintenance tasks, Contractor to adjust as needed per field conditions and final assembly of components at no additional cost.

## **2.13 AUTOMATIC CONTROLLER**

- A. Automatic controller shall be as called for on the plans and include all options and accessories required to function independently and automatically, including receiving updated climate information, flow sensing, and information for programming adjustments as required by the model.
- B. Contractor to include in bid all support items required by the manufacture for a fully functional automatic irrigation control system, including if required:
  1. All relays, pump starts
  2. Flow sensors
  3. Decoders
  4. Coaches switch/Cool down controls
  5. Remotes
  6. Specialized wire connections per manufacturer
  7. Grounding for accessories per manufacturer

## **2.14 ELECTRICAL**

- A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installation.
- B. All electrical work shall conform to local codes and ordinances.

## **2.15 WIRING**

- A. Remote control wire shall be direct-burial AWG-UF type, sized according to manufacturer's specifications per the drawings, and in no case smaller than 14 gauge.
- B. Wire connectors shall be either Spears Dri-Splice, 3M DBR/Y, and or 3M 3570GN Direct burial type water proof connectors per the details or the manufacturers requirement's which ever more stringent.
- C. Common wires shall be white in color. (Where two or more controllers are used, the common wires shall be white with a different color stripe for each controller.) Control wires shall be black (where two or more controllers are used, the control wires shall be a different color for each controller.) These colors shall be noted on as-built plans located on controller door.
- D. All wires shall be numbered and marked with 3M wire marking tape numbering system or approved substitution at the controller and any pull boxes where more than 10 wires are present.

## **2.16 SPRINKLERS**

- A. Sprinklers shall be as called for on the plans.

## **2.17 FERTIGATION**

- A. If called for on the plans shall be provided by Eco-Fert fertigation. Contractor shall coordinate installation and programming with Eco-Fert. Eco-Fert System Number EFSS-FP1. Coordinate Installation with Eco-Fert (949) 766-5800 and include all conduits and electrical service for installation. Fertigation system shall include, but not be limited to the following components as a minimum:
  - Walchem Pump
  - Signet 9900
  - Schedule 80 4" fittings
  - Extension Boxes
  - GF 2536
  - Saddle
  - Stainless Steel Cabinet/Pedestal
  - Tank
  - 4 pin connectors
  - 5 pin connectors
  - Madison Horz float
  - Valve Boxes
  - Fan.



## **PART 3 - EXECUTION**

### **3.01 GENERAL**

#### **A. Water Supply:**

1. Connections to or for the installation of the water supply shall be at the locations shown on the drawings. Any changes caused by actual site conditions shall be made at no additional cost to the Owner.

#### **B. Electrical Service:**

1. Contractor shall make and supply all electrical connections including conduit, wiring, and support breakers and switches to supply the irrigation controller, booster pump, and fertigation system in addition to any required ancillary equipment.

#### **C. Layout:**

1. Layout irrigation system prior to excavation and make minor adjustments required due to differences between site and diagrammatic drawings/plans. All equipment to be located within planter areas. It is the Contractors responsibility to notify the Landscape Architect of any items of concern prior to start of installation. Any changes in layout or design by the Contractor not disclosed and approved prior by the Landscape Architect are made at the Contractors sole liability.

#### **D. Diagrammatic Intent:**

1. The drawings are purposely diagrammatic, due to scale it is impossible to show all items in their actual location on the plan. The size and location of equipment and fixtures are drawn to scale where possible to show overall system makeup and design. Provide offsets in piping and changes in equipment locations as necessary to conform with structures, hardscape, and to avoid obstructions or conflicts with other work. Contractor shall not willfully install any equipment that would be out of place, cause issue/ interference with other work, or appear to be out of location per industry standards. All equipment shall be located in landscape areas unless specifically approved by the Owners Representative prior to installation for any non-conforming circumstances.

#### **E. Modifications:**

1. Provide modifications to the irrigation system to avoid blockage of sprinkler irrigation patterns, to prevent overspray and excessive runoff onto walkway and parking areas, and to provide full irrigation coverage to the planted areas. Such modifications also include adjusting locations and adding heads as required to spray around trees, light poles, sign posts, other objects that obstruct spray pattern, and any other adjustments required due to field conditions unknown at the time of design. All cost's associated with Modifications are the Contractors sole responsibility as they shall be considered part of the bid.

#### **F. Grades:**

1. Before starting work, carefully check all grades to determine that the site is properly graded and work may safely proceed, keeping within the specified material depths with respect to finish grade.

#### **G. Inspections:**

1. Prior to all work of this section, carefully inspect the current work of all other trades and verify that all such work is complete to the point where this installation may properly

commence. Any installation prior to the completion of other trades that requires work to be adjusted or redone is the sole responsibility of the contractor.

2. Verify existing grades are correct and that proper coverage per the details and final equipment locations and heights are correct. Any work installed that is found to be incorrectly installed per the details that requires adjustment to equipment or pipe relocation is the sole responsibility of the Contractor.
3. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

H. Discrepancies:

1. In the event of discrepancy, notify the Owners Representative and the Landscape Architect prior to starting work.
2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved and approval of solution has been granted in writing.
3. Failure of the Contractor to accurately lay out or knowingly install the system in a way that creates design inadequacies without prior acknowledgement to the Owners Representative will be the direct responsibility of the Contractor to remedy without any additional costs or impact to the Owner.

I. Field Measurements:

1. Contractor shall be responsible to make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other trades, including the proper location of required sleeves, and support items that may involve other trades.

### **3.02 INSTALLATION STANDARDS**

- A. The landscape irrigation system shall be installed in accordance with applicable requirements of the California Plumbing Code and California Electrical Code, and the requirements of the jurisdictional water company or utility district.
- B. Manufactured materials and equipment shall be installed in accordance with the respective manufacturer's instructions for the location and conditions.

### **3.03 TRENCHING**

- A. Dig trenches and support pipe continuously on bottom of ditch. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
- B. Contractor responsible for all trenching activities which shall be in accordance with current safety and OSHA requirements.
- C. Provide minimum cover of 24 inches, maximum 30 inches on pressure supply lines 3 inches and larger.
- D. Provide minimum cover of 18 inches, maximum 24 inches on pressure supply lines 2 inches and smaller.

- E. Provide minimum cover of 4" for subsurface drip lines, or as recommended by the subsurface drip line manufacture.
- F. Provide minimum cover of 18 inches, maximum 24 inches for control wires.
- G. Provide minimum cover of 12 inches, maximum 16 inches for non-pressure lines.
- H. Provide minimum cover of 24 inches, maximum 30 inches for all pipe sleeved under paving.
- I. Provide minimum cover of 36 inches in infiltration areas (6" minimum backfill cover over pipe beneath gravel layer).
- J. When two pipes are to be placed in the same trench, maintain a six-inch space between pipes as a minimum. No pipe shall be installed directly over or next to another
- K. For pressurized lines, snake as needed in the trench to allow for minor expansion and contraction depending on the type of pipe used. Follow manufactures recommendations.
- L. Where it is necessary to excavate adjacent to existing trees, the Contractor shall avoid injury to trees and tree roots. Excavation in areas where 2-inch and larger roots occur shall be done by hand. All roots 2 inches and larger in diameter shall be tunneled under and shall be heavily wrapped with wet burlap to prevent scarring or drying. Where trenching machine is run close to trees having roots smaller than 2 inches in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making a clean cut through the roots. Roots 1 inch and larger in diameter shall be painted with two coats of Tree Seal or approved equal. Trenches adjacent to trees shall be closed within 24 hours. Any damage to tree root structure and resulting decline will be the sole responsibility of the Contractor.
- M. After trenches have been excavated, pipe shall be installed, tested, and inspected, and the trench shall be backfilled without undue delay.

### **3.04 PIPING**

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphaltic concrete pavement.
- B. Cutting or breaking of existing pavement is not permitted.
- C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, and burrs and reaming; install pipe with all markings up for visual inspection and verification.
- D. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings; store plastic pipe and fittings under cover until ready to install; transport plastic pipe on a vehicle with a bed long enough to allow the pipe to lay flat, avoid undue bending and any concentrated external load.
- E. Remove all dented, crushed, scratched, and damaged pipe sections.
- F. Contractor shall install concrete thrust blocking at all changes of direction and terminal points of pressure pipe per plans.
- G. All lines shall have a minimum clearance of 6 inches from each other and 12 inches from lines of other trades.
- H. Parallel lines shall not be installed directly over one another.
- I. In solvent cementing/welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods; allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

- J. Solvent cementing/ welding shall be neat and demonstrate quality workmanship- Primer and Glue shall not be used in excess or applied in a way to affect the portions of the pipe that are not part of the actual connected joint. Any joints with excessive runs/drips, trails, or globing of Glue and or Primer shall be cut out in whole and replaced at cost by the Contractor until an acceptable professional product is completed and accepted by the Owners Representative
- K. 360-degree applicators shall be used to apply primer and solvent on sizes - 2 inches and larger.
- L. Center load all plastic pipe prior to pressure testing.
- M. All threaded plastic-to-plastic connections shall be assembled using Teflon tape.
- N. For plastic-to-metal connections, work the metal connections first. Use a nonhardening pipe dope on all threaded plastic-to-metal connections, except where noted otherwise.
- O. Snake all piping to allow for expansion and contraction due to environmental conditions.

### **3.05 ASSEMBLIES**

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practice.
- B. Install backflow assemblies at locations approved in the field and at height required by local codes.
- C. Valves shall be installed in Landscape areas whenever possible per Owners Representative standards.
- D. Each valve box shall be installed on a foundation of gravel backfill; 3 cubic feet minimum. Place boxes on common bricks bedded in backfill per details. Valve boxes shall be installed with their tops ½" inch above the surface of surrounding finish grade in lawn areas and 2" inch above the surface of surrounding finish grade in shrub areas or per details.
- E. Valve box risers or extensions shall be installed as needed per field conditions at no additional cost, they shall be by the same manufacture as the installed box.
- F. Areas with burying rodents will require metal fabric or wire mesh installed under boxes prior to gravel and shall be placed at all other possible entry points to protect the equipment from damage. All cost associated with wire fabric installation shall be the responsibility of the contractor.

### **3.06 BACKFILLING**

- A. Before pipeline trenches are backfilled, the irrigation system shall be pressure tested and the location of irrigation heads modified as required to obtain complete and uniform coverage of each plant's root ball. Refer to field quality control requirements specified herein.
- B. Initial backfill on all lines shall be of fine granular material with no foreign matter larger than 2 inch in size. Reference section 217-1.1 of the "Greenbook" for further requirements of bedding material. All protruding rocks or other material capable of damaging pipe will shall be removed from trench walls or bottom prior to placement of pipes or conduits.
- C. Compaction of backfill in landscaped areas shall be not less than that of surrounding ground as determined by ASTM D1557.
- D. Backfill shall be tamped in 4-inch lifts under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Materials shall be sufficiently damp to permit

thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.

- E. Flooding in lieu of tamping is not allowed without specific prior approval.
- F. Under no circumstances shall truck wheels be used to compact soil.
- G. Provide washed sand backfill a minimum of 6 inches over and under all piping under paved areas.

### **3.07 CONTROLLER**

- A. The exact location of the controller shall be approved by the Owners Representative before installation. The electrical service shall be coordinated to this location by the Contractor.
- B. Fertigation controller will be located next to fertigation unit per plan if included. Maintenance access shall be provided.
- C. Pump starter shall be connected to controller pump starter relay switch.
- D. The irrigation system shall be programmed to operate during the periods of minimal use of the design area, and for maximum efficiency.
- E. Testing Requirements:

All manufacturer requirements for certification and or warranty release of the system in addition to electrical code requirements are the Contractors responsibility to meet and supply proof in the form of documentation of inspection and compliance.

### **3.08 WIRING**

- A. Wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines and shall be located below the supply lines wherever possible.
- B. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.
- C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
- D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional turn, and one of 24 inches shall be provided at each remote-control valve.
- E. A continuous run of wire shall be used between a controller and each remote-control valve. Under no circumstances shall splices be used without prior approval.

### **3.09 FLUSHING THE SYSTEM**

- A. Prior to installation of sprinkler heads, the valves shall be opened and a full head of water used to flush out the lines and risers.
- B. Sprinkler heads shall be installed after flushing the system has been completed.

### **3.10 SPRINKLER HEADS**

- A. Sprinkler heads shall be installed as designated on the drawings and per Owners Representative standards.
- B. Spacing of heads shall not exceed maximum indicated on the drawings.

### **3.11 ADJUSTING THE SYSTEM**

- A. Contractor shall adjust valves, align heads, and verify coverage of each system prior to coverage test.
- B. If it is determined by the Owners Representative that additional adjustments, heads or nozzle changes/ additions will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to acceptance and any planting. (See 3.01 section E)
- C. The entire system shall be operating properly before any planting operations commence.

### **3.12 PLANT ESTABLISHMENT**

- A. Contractor to continually check and adjust the system for proper run times, coverage, and function throughout the Plant Establishment Period listed in Section 32 93 00 – Plants.

### **3.13 COMPLETION CLEANING**

- A. Upon completion of the work, Contractor shall smooth all ground surfaces; remove excess materials, rubbish, debris, etc.; sweep adjacent streets, curbs, gutters, walkways, and trails; and remove construction equipment from the premises. Contractor is responsible for removing and cleaning any tracking, tire marking, or other visible signs of damage to existing facilities.

END OF SECTION

**SECTION 32 90 00**  
**PLANTING**

**PART 1 – GENERAL**

**1.01 SCOPE**

- A. The work required is indicated on the drawings and includes but is not necessarily limited to: soil preparation; finish grading; planting trees; guying and staking trees; planting shrubs and ground cover; soil erosion control; maintenance; plant establishment period; guarantees; and replacement.

**1.02 RELATED SECTIONS**

- A. Related work specified elsewhere:
  - 1. 32 84 00 Planting Irrigation
  - 2. 32 90 05 Planting Maintenance

**1.03 GUARANTEE**

- A. All trees installed under the contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship of installation for a period of one (1) year.
- B. All plant material 15 gallon or larger shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship of installation for a period of one (1) year.
- C. During the guarantee period, any material found to be dead, in decline, missing, or in poor condition shall be replaced by the Contractor within ten (10) days of written notification. The Owners Representative/ Landscape Architect shall be the sole judge as to the condition of the material.
- D. Replacement shall be made in accordance with these specifications and the plans and shall be material matching the current size and condition of the existing material at the time of replacement.
- E. Material and labor involved in replacing plant material shall be provided by the Contractor at no additional cost to the Owner including any shipping, delivery, and or specialized installation methods such as craning, rigging, or impact to surrounding landscape.

**1.04 REFERENCES**

- A. The Standard Specifications for Public Works Construction, "Greenbook", latest edition, is reference as if herein contained and the contractor shall keep a copy at the project site. These Specifications shall supersede conflicts with information given in the "Greenbook", unless otherwise determined by the Owner or their designated representative.

**1.05 QUANTITIES AND TYPES**

- A. Plant materials shall be furnished in the quantities and/or spacing as shown and noted for each location, and shall be the species, kinds, sizes, etc. as symbolized and/or described in the "Plant Materials Legend", as indicated by the drawings. The Landscape Architect has provided this list and/or counts only as a convenience to the Owner and Contractor and assumes no responsibility for its accuracy. As part of his/her bid the Contractor shall be solely responsible for accurately identifying the counts and species as shown on the plans by symbols. Any questions or clarifications shall be brought up during the bidding process or shall be resolved as solely directed by the Owners Representative or Landscape Architect.

#### **1.06 VERIFICATION OF DIMENSIONS**

- B. Dimensions are approximate, before proceeding with any work, Contractor shall verify all dimension and shall immediately inform the L.A. and owner of any discrepancies between the drawings and/or specifications and actual field conditions. Minor adjustments to planting locations for interference with infrastructure or other site features shall be included in the bid by the contractor. No work shall be done in any area where there is such a discrepancy until approval has been given by L.A. and owner. Any work done without notification and prior approval will be the sole responsibility of the Contractor to remedy as directed by L.A. and Owner.

#### **1.07 INSPECTIONS**

- A. Inspections will be required to observe and verify the work. The Contractor shall contact the Owners Representative at least 48 hours (2 working days) in advance of an anticipated inspection. An inspection will be required at each of the steps listed below:
1. Upon completion of fine grading, and prior to commencement of soil preparation, for acceptance of fine grading work and taking of soils samples.
  2. Inspection of completed finish grading work per this section following soil amendment work.
  3. Percolation test of selected planting tree locations.
  4. On site delivery of plant material.
  5. When trees and shrubs are spotted for planting, but before planting holes are excavated.
  6. When planting and all other indicated or specified work has been completed.
  7. During application of pre-emergent chemical.
  8. At start of plant establishment and maintenance period.
  9. At the end of the plant establishment period, concurrent with final acceptance of the project for maintenance by the Owner. This acceptance for maintenance will be confirmed in writing by the Landscape Architect or Owners Representative.

#### **1.08 SOILS TEST**

- A. Agronomic soil analysis shall be required with interpretation and recommendations



(include texture, organic matter, estimated nitrogen release, Phosphorus (P 1, P 2), potassium, magnesium, calcium, soil pH, hydrogen, cation exchange capacity, percent base saturation, soluble salts, excess lime rate, sodium and boron at the acceptance of fine grading. Total amount of tests required shall be as stated per the plans or at a minimum of 1 test per 25,000 sq. ft. whichever is greater. The tests shall be individual to identify any irregularities in soil types on site and amend them as necessary per plant or area needs. Creating a single composite mix of all samples is not allowed. The final approved recommendation shall take precedence over the minimums listed herein or elsewhere in the plans. Recommendations shall be based on the plants listed per the planting plans specifically. The recommendations shall call for any needed special requirements for the listed trees, shrubs, ground covers, turf, and or any other special species requirements. Any additional costs due to recommendations of the soil test shall be the responsibility of the Contractor who has reviewed the site during bidding and made their own observations and test as needed to make an accurate bid based on the site conditions and their experience as a Contractor. See plans for amount and locations of tests required based on project size. All costs for testing shall be the responsibility of the Contractor and included in their bid as well as the proper scheduling allowing for analysis and reporting lead times.

- B. Any results or recommendations that require additional re-testing to verify required mitigation or amendments performance shall be included by the contractor at no cost to the owner.
- C. Any Additional mitigation or amendments that may be required by as stated by additional testing and are found to be a result of the Contractor failing to meet the original requirements shall be corrected in full to the requirements of the recommendations by the Contractor at no cost.

#### **1.09 SUBMITTALS**

- A. Contractor to submit date stamped photos documenting current appearance of each plant listed in the plant legend within 15 days of the Notice to Proceed. Photos shall clearly document size and condition from the nursery, including height, spread, and size of caliper noted for trees for approval by Landscape Architect.
- B. In addition to photos the Contractor shall supply documentation of the required quantities available from the supplier at the time of submittal, it is the Contractor's responsibility to procure all plant material ahead of delivery once the submittal is approved. Any additional cost as a result of scheduling or order of operations for holding, growing, and caring for plant material shall be included in the Contractor's bid.
- C. Contractor to submit written recommendations from a Certified Pest Control Advisor for all herbicides and pesticides to be used on site for approval by Landscape Architect.
- D. Contractor to submit samples of Mulch or other listed ground cover material per plan in a 1-gallon zip-lock type plastic bag for approval by Landscape Architect.
- E. The following written certifications and or delivery tickets are required to be submitted to the Landscape Architect upon delivery of the respective materials to the job site:
  - 1. Total Quantity of commercial fertilizers by type

2. Total Quantity of soil amendments and conditioners by type
  3. Total Quantity of mulch
  4. Total Quantity of iron sulphate
  5. Also, all items per section 32 92 00 (turf seeding or sod if applicable)
- F. All bagged products (fertilizers, etc.) shall stay on the site in a neat and orderly manner until the final approval by the Landscape Architect.

#### **1.11 SUBSTITUTIONS**

- A. Substitutions for any indicated plant material shall be permitted only if the provided substituted materials are approved in advance at the start of work, and if found to be acceptable by the L.A. with no additional costs to the owner. The L.A. has final authority on the approval of substitutions based on their opinion of overall impact to plant palette and the substitutions previous performance. No substitutions shall be allowed based on failures of the Contractor to locate and reserve plant quantities at the time of award. For any additional required inspections, nursery visits, or staff time spent verifying additional plant material after the original approval will be the responsibility of the Contractor and charged at the Landscape Architects current rates at time of Design Award.

#### **1.12 PROOF OF PLANT MATERIAL NURSERY DEPOSIT/PURCHASE**

- A. The Contractor shall be responsible for proof of plant material procurement prior to submission of first Pay Application. Plant material must be located, have submittals approved, and some form of either deposit or full payment for reserving the plant material and any ongoing maintenance required by the seller based on the Contractors approved schedule for plant delivery to the site. Failure to provide the documentation of proof of purchase will result in a delay of payment approval and processing. This is required due to supply chain issues and limited availability of plant material in the current market conditions and there affect on project timelines if not secured at the properly at start of the project.

#### **1.13 WARRANTY**

- A. General:
- B. The Contractor shall guarantee all plant material against all defects and fault of material and workmanship for the entire period of the plant establishment/maintenance periods. The Contractor shall guarantee all trees and plant material 15 gallon and larger for a period of one year from completion of plant establishment. Any trees that fail or are found to be in decline shall be replaced by the Contractor at no cost to the owner. The final decision on the health and status of the material will be the sole discretion of the Landscape Architect and or the Owners Representative.
- C. Should any problem with the planting installation be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to the Owner within ten (10) calendar days of receipt of written notice from the Owners Representative. When the nature of the repairs as determined by the Owners Representative constitute an emergency (I.E. Tree failures, Etc.) the Owner may proceed to make repairs at the Contractor's expense. Any and

all damages to existing improvements resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owners Representative by the Contractor, all at no additional cost to the Owner.

**PART 2 - MATERIALS**

**2.01 SOIL AMENDMENTS, FERTILIZER, AND CONDITIONERS**

Samples of soils amendments and plants shall be submitted for inspection and stored on the site until furnishing of materials is completed. Photographs may be used for Plant Material if they include the following: date of image, person or object for scale, nursery name and contact info, multiple views of any items 24" or larger. Delivery may begin upon approval of samples and completed grow and kill period, or as directed by the Owner's Representative. Substitutions in any material will not be permitted unless presented during bidding and specifically approved in writing by the Owner's Representative in the form of an official bid addendum.

**A. Soil and Soil Amendments:**

1. Fertilizer and amendments for soil conditioning and maintenance shall bear the manufacturer's guaranteed analysis and shall be as recommended in the required soils laboratory report.
2. Fertilizer tablets if called for shall be Gro-Power 7 gram 12-8-8, to be applied per Manufacturer's Specifications.
3. Myco tabs if called for shall be TRI-C 1.68 gram Myco Tabs(Mycorrhizal + NPK) to be applied per Manufacturer's Specifications.
4. Myco Paks if called for shall be TRI-C 4 gram Myco Paks to be applied per Manufacturer's Specifications.
5. Premium Humate if called for shall be TRI-C premium humate applied per manufacturer's specification for soil preparation via Rototilling.
6. Revival Plus if called for shall be TRI-C Myco Revival plus and installed in conjunction with TRI-C humate per manufacturer's specifications.
7. Organic amendments if called for shall be nitrolized redwood sawdust (.5% actual nitrogen), or Fir Bark 1% nitrogen). It shall be fine textured, having minimum 80% passing #8 screen and minimum 95% passing #4 mesh screen. Salinity shall be no higher than 3.5 milliohms per centimeter at 25 Centigrade as measured by saturation Pine shall not be used as an organic amendment.

**B. Application Rates**

Application rates when called for shall be at a minimum as listed below - Note: Soil analysis may adjust listed rates and shall take precedence.

1. Fertilizer tablets- Apply 7 grams Gro-Power tablets at the following rates per plant by size:
- |  |  |
|--|--|
| Shrubs:  | Trees:   |
| · 1 gal. shrub – 3 tablets   | 24" box tree – 16 tablets                        |
| · 5 gal. shrub – 8 tablets   | Larger sizes: For each 1/2" caliper measured 14" |
| · 15 gal. & 24" box shrubs – 15 tablets  | above soil level use 3 to 4 tablets.             |
| Ground Cover:  |  |
| Apply one 7 gram Gro-Power tablet per rooted ground cover cutting/ 4" pot. Refer to Manufacturer's Specification for installation procedure. |  |

2. Myco tabs shall be used at the following rates per plant by size:
 

· 1 gal - 2 tabs	48" box – 34 tabs
· 5 gal - 8 tabs	60" box – 40 tabs
· 15 gal – 16 tabs	72" box – 46 tabs
· 24" box – 22 tabs	84" box – 52 tabs
· 36" box – 28 tabs	96" box – 60 tabs
3. Myco Pak shall be used at the following rates per plant by size:
 

· 1 gal – 1 pak	24" box – 12 paks
· 5 gal – 3 paks	36" box – 18 paks
· 15 gal – 8 paks	48" box – 22 paks
4. Premium humate shall be incorporated at 50lbs. per 100 square feet
5. Myco Revival Plus shall be topically applied per manufacture and watered in accordance with the manufacturer's instructions

**C. Inorganic Conditioners:**

Inorganic conditioners shall be agricultural grade gypsum, soil sulfur and iron sulphate. Iron sulphate shall be ferric sulphate or ferrous sulphate in pelleted or granular form containing not less than 18.5% iron, expressed as metallic iron, and shall be registered as an agricultural mineral with the State Department of Agriculture in compliance with Article 2 "Fertilizing Materials", Section 1030 of the Agriculture Code.

**2.02 PLANTS**

All plants shall be true to name, and one of each bundle or lot shall be tagged with the name and size of plants in accordance with the standards of practice recommended by American Standard for Nursery Stock ANSI Z60.1-2014. The root condition of plants furnished in containers shall be determined by removal of earth from the roots of not less than two plants nor more than 2% of the total number of plants of each species or variety except when container-grown plants are from several different sources: in which case, the roots of not less than two plants of each species or variety from each source shall be checked by the Owners Representative / Landscape Architect at his option. The selection of plants to be checked will be made by the Owners Representative / Landscape Architect. All plants rendered unsuitable for planting shall be considered as samples, and replacements shall be provided at no additional cost. In case the sample plants are found to be defective, the entire lot or lots of plants represented by the defective samples will be rejected.

- A. All trees and shrubs supplied by Contractor shall be of the specified standard height and diameter set by the American Standard for Nursery Stock. The height of the trees shall be measured from the root crown to the last division of the terminal leader and the diameter shall be measured six (6) inches above the crown roots. The trees shall stand erect without support.
- B. No plants or trees shall be accepted with compromised root systems, including girdling, root bound, and or recently up planted from smaller container stock.
- C.

- D. Container stock shall have grown in the container for at least 6 months, but not over two years.
- E. Do not prune any plants prior to delivery without specific prior approval.
- F. Material that has been trimmed, damaged, or does not meet the standard approved viaphotographs will be rejected.
- G. All cost associated with returning and replacing rejected material shall be the Contractors sole responsibility.
- H. Substitutions shall not be permitted unless the contractor can prove in writing that no specimens can be located within 100 miles of the project. A minimum of 5 notices from suppliers stating the plant is not available are a required.
- I. At all times plants shall come from Nursery stock grown in similar conditions and climate zones as associated with the project.

## **2.02 BACKFILL MATERIAL**

- A. Topsoil shall be free from noxious weed seed and shall be of a loam characteristic, fertile and friable.
- B. Wood shavings shall be leached nitrogen fortified and shall be free of foreign matter.
- C. Soil used for backfill of planting pits for bidding purposes shall be enriched using the following blend per cubic yard (agronomic soil test recommendations shall take precedence where the minimum amounts are exceeded):
  - 60% site soil or
  - approved import 40%
  - wood shavings
  - 17 lbs. soil condition/fertilizer (Gro-Power Plus) 1 lb. iron sulphate

All plant pits shall be backfilled with backfill mix as specified above.
- D. All soil backfill shall be bulk mixed, not individually mixed at each plant pit.

## **2.03 STAKES AND TIES**

- A. Tree stakes shall be 3" dia. x 10-foot-long straight-grained copper naphthenate treated lodgepole pine unless called for differently per the plans. Stakes shall be free from knots, checks, splits, or disfigurement.
- B. Tree ties shall be "Cinch-Tie Tree Support" supplied by V.I.T. Co., Escondido, California, (760) 480-6702. For 5- 15-gallon trees, Model CT24; for 24"- 36" box trees, Model CT32. Total amount of ties per tree shall be as called for by the Details.
- C. Multi-stem trees and 48" box trees and larger shall require underground tree guying/earth anchors system that include strapping of the root ball and soil anchors. Duckbill Root Ball anchor sized per manufactures recommendations or approved substitution shall be required.
- D. Tall vertical growing specimens, similar to Italian Cypress or Brisbane Box trees shall

require special staking requirements designed to align and support their long single leader growth habits. This shall include using 20' length sch. 40 steel pipe or similar staking device that may require special installation and tie methods. Contractor to include alternative staking methods based on tree types as required by plans in the total cost of their bid.

## **PART 3 - EXECUTION**

### **3.01 LANDSCAPE GRADING**

- A. The Contractor shall complete preliminary grading as required by adding soil, removing surplus soil, removing rocks and debris over 1 inch in diameter within the top 2" of soil in flat and slope areas, and removing rocks over 2" in diameter within the top 6" of soil in areas with slopes less than 3:1. Bring all areas to be landscaped to finish grade. All areas shall slope to drain. Flow lines shall be established to drain inlets, existing road curbs, sidewalks, and or other drainage conveyance structures as shown on the grading plans. Contractor shall notify Owners Representative/ Landscape Architect of any areas that appear to have drainage issues prior to soil preparation for complete mitigation and or correction.
- B. The Contractor shall key/cut and remove all soil for mulch, ground cover, turf interfaces with hardscape per the details to retain minimum depth and final finish alignment.

### **3.02 WEED AND PEST CONTROL MEASURES**

- A. Upon completion and acceptance of all fine grading work and prior to soil preparation, the Contractor shall perform weed control (Grow/Kill) measures as follows:
  1. Irrigate all areas designated to be planted for a minimum of 10 minutes per setting, two settings per day for 14 days continuously to germinate existing seed bank.
    - In instances of point source or drip irrigation it is the Contractors responsibility to completely irrigate all planting areas which may require additional or supplemental irrigation above the designed system per plans. This may include adding above ground temporary irrigation, watering from water trucks/tanks, and or hand watering and shall be included in the Contractors bid.
  2. Apply a contact non selective herbicide per the written recommendations of a Certified Pest Control Advisor specific to the site- allow 7 days or sufficient time to pass to allow a complete kill of all weeds germinated.
  3. Remove all weeds present including any viable root systems and above ground vegetation.
  4. Repeat step one for only 7 days and then follow steps 2-3 as above until weed cover is less than 1%.
  5. Contractor to indicate on master schedule total grow kill period as part of submittals.
  6. Contractor shall call for inspection and verification of the completion of the Grow

Kill Period prior to planting.

7. If the Contractor wants to phase the grow kill operation, the Contractor will be responsible for providing plans documenting treatments including start and stop dates, in addition to reporting and requesting additional inspections for verification.
8. Any failure by the Contractor to continually irrigate or miss herbicide or clean up windows as listed above would require the process starting over from step one.
9. Contractor is responsible for the purchase and erection of all signs and barriers required to prevent intrusion into treated areas in addition to all required forms of public notice as required by the PCA responsible for the recommendation, local governing organizations, and or manufacture requirements for the safe and responsible use of products.
10. No material or method applied shall affect the success or ability of hydroseeded or planted material to germinate/thrive.
11. During grow and kill operations the Contractor shall also re-access any possible rodent or herbivore activity and continue removal and or treatment programs to maintain a pest free site and a boundary or buffer zone. This shall include areas outside of planting limits if within the project property to create buffer zones.

### **3.03 SOIL PREPARATION**

- A. All fine grading and mounding and all weed control measures shall be documented, completed, and approved prior to any soil preparation.
- B. This work shall not commence until the agronomic soils tests have been completed. Should 30 calendar days elapse between completion of soil preparation and commencement of planting, all areas shall be prepared again.
- C. In planting areas with gradients less than 3:1, a layer of soil amendments shall be spread and rototilled into the soil to a minimum depth of 4 inches, or as required by the soils report, so that the soils shall be loose, friable, and free from all rocks, sticks, and other objects undesirable to planting.
- D. The following soil amendments shall be used for estimating purposes if soil tests are not provided a time of bid and be added per 1,000 square feet to all planting areas with gradients less than 3:1 (agronomic soil test recommendations shall take precedence where these minimum amounts are exceeded). Contractor shall be responsible for any additional cost due to Soil report recommendations and shall have inspected and understood the current soil conditions at time of Bid. (Note: the following is for typical ornamental planting installation- they shall not apply to Native plantings, see Soil Management report for further information if included in plans)
  1. 3 cubic yards organic amendment
  2. 200 pounds soil conditioner/fertilizer (Gro-Power Plus)
  3. 25 pounds gypsum

All landscape areas shall be re-fine graded to "dress out", maintain, and/or reestablish grades and flow lines as approved prior to amending the soil. Fine grades will be inspected upon completion. Contractor shall not proceed with planting work until fine

grades have been inspected and accepted by the Landscape Architect

- E. Moisture Content - The soils shall not be worked when the moisture content is so great that excessive compaction will occur; and not when it is so dry that dust will form in the air or that clods will not break easy. Water shall be applied, as necessary, to provide ideal moisture content for tilling, planting, and required dust control.
- F. Note: Special soil preparation areas such as drainage basins or areas with different agronomic requirements shall be per plan and or notes/details.

### **3.04 FINISH GRADING**

- A. After completion of all soil preparation work the Contractor shall finish grade all planting areas filling as needed or removing surplus dirt, removing rocks and debris over 1 inch in diameter, and floating to a smooth uniform grade. All areas shall slope to drain. Flow lines shall be established to inlets, road curbs and/or other drainage means as shown on the plans and as directed.

### **3.05 PLANTING**

- A. Prior to planting the Contractor shall dig test planting holes for percolation tests. Per direction of the Landscape Architect, locations shall be selected to address all soil types and situations on site, such as examples for slope, exposure, soil type, etc. Holes will be dug to the depth per planting details and filled to 25% capacity with water. Test start time will be documented and checked every half hour until fully infiltrated to ensure proper drainage. Any areas found to not infiltrate per the recommended time frame will require additional drains and specialized planting techniques per the details for Trees and Shrubs in Wet Soils, which require deeper pits, additional gravel sumps, and drain pipes.
- B. Trees and Shrubs: Plant holes shall be dug to size as indicated in the drawings. Before trees and shrubs are set in the holes, all holes shall be pre-watered as follows:  
  
All planting holes shall be filled to the brim with water and allowed to drain before any planting is done. If water does not drain out of hole within 24 hours, this fact must be brought to the attention of the Landscape Architect so that corrections can be made. Correctional work shall not be considered an extra, as it will be the Contractor's sole responsibility as part of soil preparations to remedy any localized soil issues.
- C. Soil surrounding planting pit shall be in a friable condition and moist to a depth of 8".
- D. Backfill using specified soil mix per the details to within 8" of finish grade. At this depth, place the fertilizer tablets or Mycro packs/ tabs per details. Complete backfilling to finish grade.
- E. Plants and Trees shall be planted at such a depth that the crown roots bear the same relative position to finish grade as they did to the soils where they were grown. At no time shall the soil level be raised around the crown. Backfill after planting shall be compacted carefully into place without injuring the roots of the tree or breaking up the ball of earth surrounding the roots.
- F. Contractor shall create and mound soil as required for water basins per the details including adding slope guards, stones for root cover/ soil moisture protection on southwestern exposures, trunk protection, and additional straw wattles when required.
- G. All excess soil spoils and excavated debris shall be removed from the site by the



Contractor.

### **3.06 GROUND COVER AND VINE PLANTING**

- A. Soil preparation and fine grading shall be completed prior to ground cover planting.
- B. Mulch and fertilize ground cover areas per Section 3.03, part D. of planting specifications.
- C. All rooted ground cover and bare dirt areas are to be treated with a pre-emergent chemical (subject to approval by the Landscape Architect prior to application). Chemicals are to be applied by a DPR Qualified or Certified applicator. This treatment shall be applied at the following times during the contract: a) before planting, b) at beginning of plant establishment period, and c) at the end of plant establishment period. The Owners Representative / LandscapeArchitect shall be given a minimum of 48 hours (2 working days) notice prior to each application. No chemicals shall be applied other than in the presence of the inspector.
- D. Ground cover shall be planted below all shrubs and trees to within 12" of the shrub main stem unless otherwise noted on the plans.
- E. Ground cover and vines shall be planted in moist soil and spaced as indicated on the plans.
- F. Each plant shall be planted with its proportionate amount of flat soil to minimize root disturbance. Soil moisture shall be such that the soil does not crumble when removing plants.
- G. Following planting, ground cover and vine areas shall be regraded to restore smooth finish grade and to ensure proper surface drainage. All excess soil spoils and excavated debris shall be removed from the site by the Contractor.
- H. A 3-inch layer of mulch per plans shall be spread over the planted areas. Watering shall begin immediately following mulching.
- I. When necessary to prevent plant damage from pedestrian traffic during the initial growing stage, the Contractor shall erect temporary protective fencing to be removed at the end of the plant establishment period.
- J. Vines shall be tied to walls, fences, etc., in the manner prescribed on the plans. Temporary staking shall be removed at the beginning of the plant establishment period.

### **3.07 TREE STAKING**

- A. Stake trees as per planting details. No bare metal wire shall circle any part of any tree.
- B. All nursery stakes shall be removed at the time of planting.
- C. Contractor to adjust staking as needed for locations in high wind areas, including adding more restraints and stakes per the plans and current ISA guidelines at no additional cost.

### **3.08 WATERING**

- A. It shall be the Contractor's responsibility to maintain a balanced watering program to ensure proper growth until final acceptance of the work.
- B. Immediately after planting, apply water to each tree, shrub or vine. Apply water using a gentle spray pattern via a water wand in the planting hole until the material about

the roots is completely saturated from the bottom of the hole to the top of the ground.

- C. Apply water in sufficient quantities and as often as seasonal conditions require to keep the planted areas moist at all times per the plants requirements, well below the root system of plants.
- D. For hydroseed installation using Eco Mat or other subsurface irrigation the contractor will be responsible for any head adjustments or hand watering required to germinate the seeds against any hardscape buffer areas (typically 24") at no additional cost.
- E. Irrigation:
  - 1. Contractor shall properly and completely maintain the irrigation system. Contractor to program controller per watering schedule on irrigation plans and adjust in the field as necessary. Overhead irrigation areas to have a maximum run time of 15 minutes per cycle with additional cycles as needed. At no time will run off or erosion be allowed.

### **3.09 MULCHING**

- A. Contractor to apply a 3" minimum mulch layer to all planting areas unless specified as other ground cover treatment by the plans.
- B. Contractor to keep mulch from plant trunks as follows:
  - 1. Shrubs shall have 3" of clearance from trunks/main stems to mulch
  - 2. Trees shall have 6" of clearance from crown/ base of the flare to mulch

### **3.10 PLANT PROTECTION**

- A. The Contractor is responsible for all aspects of protection of the installed landscape from loss or damage through the Plant Establishment and Maintenance periods until the final acceptance via written notice. This shall include any additional materials or protection methodologies such as but not limited to ground wire cages, shields, trunk covers, shading, herbivore protection above/below via product use or trapping and or removal, application of deterrents, and Pest and Insect control.

### **3.11 PRUNING**

- A. All shrubs and trees shall be pinch pruned as necessary to encourage new growth and to eliminate rank sucker growth. Old flowers, and dead foliage and limbs shall be removed. No major pruning shall be done without the approval of the L.A. Any damage to shrubs and trees that drastically changes structure and or appearance shall require the Contractor to replace in kind with an approved replacement at no additional cost per the direction of the Landscape Architect.

### **3.10 MAINTENANCE**

- A. All areas landscaped by Contractor under this contract shall be maintained by said Contractor for a minimum plant establishment period of not less than ninety (90) days or as called for by the Contract documents from the date of written acceptance of initial installation and substantial completion per the requirements of the plans, specifications, and contract documents.

### **3.11 START OF PLANT ESTABLISHMENT**

- A. Criteria for start of plant establishment period:
  - 1. The plant establishment period shall not start until all elements of the project that impact the landscape are completed in accordance with the contract documents. Projects will not be segmented into phases.
  - 2. Permanent Water and Power to remote controllers shall be established.
  - 3. Fully automatic irrigation including acceptance of installation and as-builts/controller charts.
  - 4. Written acceptance of the Owners Representative must be obtained prior to the start of the plant establishment period.
  - 5. If the project maintenance fails to continuously meet standards required, the plant establishment period "day count" will be suspended and will not recommence until Contractor has corrected all deficiencies.
  - 6. The 90-day establishment period is the minimum required and will be extended as needed at no additional cost to remedy issues and bring the project into compliance.

### **3.12 LANDSCAPE MAINTENANCE (PLANT ESTABLISHMENT)**

- A. Refer to section 32 90 05 Landscape Maintenance

### **3.13 CLEAN UP**

- A. Upon completion of the work, the Contractor shall smooth all ground surfaces; remove excess materials, rubbish, debris, etc.; sweep adjacent streets, curbs, gutters, walkways, and trails; and remove construction equipment from the premises.
- B. This shall include power washing all hardscape, site structures, site furnishings to return them to a state of clean and unsoiled. If the finish has been soiled past the ability to be washed off the Contractor shall be responsible to returning it to a new finish state, including repainting, refinishing, and in extreme cases replacing in whole.

END OF SECTION

**SECTION 32 90 05**  
**LANDSCAPE MAINTENANCE**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Furnishing and implementing a complete landscape maintenance program to maintain all planting areas from time of Accepted plant installation through the (90) ninety-day or per contract document Plant Establishment Period and accepted Final Completion. Contractor shall note the (90) ninety-day period is the minimum for plant establishment and that failures of plant performance/establishment and or Contractor failures to properly meet all requirements shall extend the period as deemed necessary by the Owner's Representative.

**1.02 SCOPE OF WORK**

- A. Furnish all supervision, labor, materials, equipment and transportation required to maintain the landscape in a thriving condition as it establishes and take root, as specified herein.
  - 1. Care of all lawn and ground cover areas if present, including watering, cutting, edging, trimming, fertilizing and pest control within all ground cover areas as directed herein.
  - 2. Care of all shrubs, trees, and groundcover areas, including watering, cultivation, pruning, fertilization, debris removal, and pest control including but not limited to:
    - a. All cultivation and soil aeration as necessary to maintain optimum conditions for plant growth.
    - b. Fertilization of all plant material on a regular schedule, including soil testing as necessary to determine requirements and application methods with reference to the project soil analysis.
    - c. All pruning, re-staking, tightening or adjustment of guy wires or straps and trimming of plant material that is required in landscape areas to promote growth and proper structure.
    - d. Control and/or prevention of diseases, insect and or rodent infestation using methods and techniques approved by State Licensing Agency.
  - 3. Supplemental watering of plant material on a regular basis through use of automatic irrigation systems and/or hand watering as needed, while consistently monitoring and adjusting water needs to maintain optimum conditions for plant growth per each species/hydrozones requirements.
  - 4. Maintenance of irrigation systems, including adjustment of heads and valves and regular controller program updating, cleaning of filters, and fertilizer injection systems if included per plans.
  - 5. General maintenance of the site and associated amenities including removal of litter and debris, cleaning of site features, graffiti removal, and reapplication of any anti-graffiti coatings as required.
  - 6. Replacement of plantings, or other materials, that, in the Owner's Representatives opinion, require replacement due to failure, decline or the Contractor's neglect in care or maintenance at no cost to owner.

7. Protection of Property and Landscape During Inclement Weather: During periods of inclement weather, Contractor shall provide supervisory inspections of the project during regular hours to prevent or minimize possible damage from storms or weather events. Contractor shall report any storm damage to Owner's Representative.
  8. Protection of Existing Facilities and Structures: Contractor shall exercise due care in protecting from damage all existing facilities, structures, and utilities both above and below grade from maintenance activities- any damage from equipment or personnel shall be repaired or replaced immediately to the original condition of a new installation.
  9. Project Inspection: Contractor will meet with Owners Representative per approved schedule to verify compliance with specifications. Following each meeting, Contractor will submit written reports noting problems cited during inspections and any actions taken.
  10. Work Schedule: A monthly schedule shall be prepared and submitted to the Owner prior to the beginning of each month. Schedules shall indicate times, days of the week and type of work to be performed including manpower for approval.
- B. Section also includes notification and coordination with the Recreation & Park Department if present prior to completion of the Plant Maintenance Period.

### **1.03 RELATED WORK**

- A. Section 32 84 00 – Planting Irrigation
- B. Section 32 90 00 – Planting

### **1.04 REFERENCE STANDARDS**

- A. Plant Material Standards: "American Standard for Nursery Stock", current edition, American Association of Nurserymen.
- B. Staking and Guying Procedures: "Staking Landscape Trees", University of California Extension Publication #2576.
- C. Pruning Procedures: "Pruning Landscape Trees", University of California Extension Publication #2574.
- D. ISA standards and BMP

### **1.05 WORK FORCE**

- A. Supervision: Contractor shall furnish competent supervisors, to be present on the job site at all times during which work is being performed. Supervisors must possess adequate technical background, preferably with formal education in ornamental horticulture. Supervisors must be English speaking and preferably bilingual (in Spanish) if crews are Spanish speaking.
- B. General Personnel: In addition to Supervisors, Contractor shall supply sufficient working personnel capable of promptly accomplishing, on schedule, all work required under this contract during regular hours.
- C. All such personnel shall be physically able to perform their assigned work. The Contractor and his employees shall conduct themselves in a proper and efficient manner at all times and shall cause the least possible annoyance to the public. They shall be fully clothed in uniforms and suitable attire. All maintenance staff shall have ID badges and the current PPE as required by OSHA. The Owner may require the Contractor to remove from the work site any employee(s)

deemed careless, incompetent, or otherwise objectionable, whose continued employment on the job is considered to be contrary to the best interest of the Owner. All personnel shall be U.S. citizens or legal residents.

#### 1.06 WARRANTY

- A. Refer to Section 32 90 00 – Planting.

#### 1.07 SCHEDULE

- A. Submit a proposed maintenance work schedule to the Owner's Representative in writing for review at least 10 days prior to commencement of maintenance work. All maintenance work shall be done at times approved by the Owner's Representative so as not to conflict with the operation of the project.
- B. Project site must be visited twice weekly for the first (30) days and once weekly as a minimum thereafter until the end on establishment.
- C. For Projects with extended maintenance periods over 90 days see below for a reference of general required activities.

Frequency Per Month:

Operation	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Site Check	4	4	4	4	4	4	4	4	4	4	4	4
Debris Removal	2	2	3	3	4	4	4	4	3	3	2	2
Pruning	0	1	0	0	0	0	0	0	0	1	0	0
Weed Control	0	2	3	3	4	4	4	4	3	2	2	0
Clean + Sweep	2	2	3	3	4	4	4	4	4	4	2	2
Irrigation Adjustment	1	1	1	1	2	2	2	2	2	1	1	1

#### 1.08 TECHNICAL SPECIFICATIONS

- A. Turf-Mow-Edge
  - 1. Mowing
    - a. All turf areas shall be mowed once per week at a minimum- adjustments to mowing's per week may be directed dependent on turf and season.

- b. Work shall be performed on the same day each week. Initial week schedule and any changes must be approved by the Owner prior to implementation.
- c. Mowing's missed visits due to inclement weather or ground conditions from such weather shall be rescheduled and completed within 3 work days on weekly schedule and within 7 days on bi-weekly schedule.
- d. Cutting heights shall be adjusted according to the type of grass in accordance with the following:

TURF TYPE	TIME OF YEAR	CUT HEIGHT
Bluegrass and Fescue	June through September	3"
Bluegrass and Fescue	September through May	2"
St. Augustine	Year-Round	2-1/4"
Bermuda	Year-Round	3/4"
Buffalo Grass	Year-Round	1-1/2"

- e. All warm season grasses to include Bermuda, Buffalo and St. Augustine shall be mowed with a power-driven reel type mower. Bluegrass and Fescue may be mowed with either power-driven reel type or rotary type mowers. All equipment shall be adjusted to the proper cutting heights and shall be adequately sharpened.
  - f. All visible grass clippings shall be collected and removed from the site prior to the completion of that day's mowing operations or the end of the day, whichever occurs first.
  - g. All trash, leaves, paper and other debris shall be removed and disposed of off-site prior to mowing.
  - h. All walkways, roadways, trails or other areas dirtied by mowing operations shall be cleaned and all debris disposed of off-site prior to the completion of that day's mowing operations or the end of the day, whichever occurs first.
2. Edging
- a. All turf grass borders shall be neatly and uniformly edged or trimmed concurrent with every mowing with bladed tools- no string trimmers will be allowed for edging.
3. Turf Maintenance
- a. All turf areas shall be irrigated as required to maintain adequate growth and appearance.
  - b. Contractor shall monitor the requirements of the plant material, soil conditions, seasonal temperature variations, wind conditions and rainfall and shall recommend appropriate changes in duration of watering cycles. No actual changes will be implemented without prior approval of the Owner.
  - c. Special areas of consideration:
    - 1) Special irrigation zones may exist such as, sub irrigation zones for turf adjacent to hardscape. In some situations, for example in hydroseeded applications, the Contractor shall hand water as required for initial germination and establishment as part of the installation and establishment period if deemed

necessary. This will be included with the contract price and no additional cost or charges will be allowed.

4. Weed Control

- a. A regular program of approved chemical application shall be used to control weed growth, supplemented by hand removal of noxious weeds or grasses as necessary.
- b. In areas of native planting, hand removal may be the only method allowed.

5. Fertilization

- a. All turf areas shall be fertilized in accordance with soils report, specific turf requirements and or recommendations when granular fertilization is used; if no soils report exists, the following criteria shall prevail.

TURF	FORMULA	RATE	CYCLE
Bluegrass	16-6-8 w/trace elements	1 lb. actual nitrogen/ 1,000 S.F.	45 days
Bermuda	Ammonia Nitrate 33.5-0-0 16-6-8 w/trace elements	1 lb. actual nitrogen/ 1,000 S.F.	45 days
Fescue	16-6-8 w/trace elements	1 lb. actual nitrogen/ 1,000 S.F.	45 days
St. Augustine	Ammonia Nitrate 33.5-0-0	1 lb. actual nitrogen/ 1,000 S.F.	45 days
Buffalo grass	Manufacture approved crab grass preventer	Per manufacturer	45 days

B. Fallen Vegetation and Debris Removal

1. The contractor shall police the entire project area including all paved areas, planters, lawn areas, sidewalks (including common area sidewalks) and trash enclosures and collect fallen leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks, and any and all other debris to prevent unsightly and inordinate accumulations during normal maintenance working hours. Sidewalks shall be swept or washed as necessary to keep free of trash and graffiti. Collected items shall be promptly removed and taken to a legal disposal site.

C. Removal of Dead Animals or animal waste

1. Removal and legal disposal of animal carcasses and animal waste are considered a normal maintenance task for the duration of the maintenance period. Dead carcasses shall be legally removed immediately when discovered by the contractor. For areas that include dog parks all animal waste shall be immediately removed once discovered by the contractor.

D. Erosion Control

1. Any installed erosion control measures such as straw wattles, silt fences, sand/gravel bags, etc. are to be continually maintained throughout the project by the Contractor. This shall



include sediment/soil removal and replacement, BMP maintenance and replacement to due to damage, failure, or end of life.

2. The contractor is responsible for daily visual inspection of landscape areas and slopes and immediately reporting areas experiencing erosion to the landscape architect and/or owner's representative on the same day noticed. If the contractor fails to notify the landscape architect and/or owner's representative of areas experiencing erosion on the same day noticed, then the contractor assumes full responsibility for any erosion control measures and/or repairs as directed by the landscape architect and/or owner's representative at no additional cost to the owner.
3. The contractor is responsible for immediately repairing and correcting any progressive rilling that may occur.
4. Erosion control measures may include but not be limited to:
  - a. Filling
  - b. Raking
  - c. Redirecting runoff
  - d. Properly programming irrigation operations
  - e. Replanting
  - f. Replacing mulch
  - g. Providing additional erosion control materials such as:
    - 1) Jute matting
    - 2) Filter Fabric
    - 3) Hay bales
    - 4) Hay rolls
    - 5) Silt fencing
    - 6) Sand Bags
    - 7) And/or other erosion control items as required to maintain healthy plant material and stable slopes.
- E. Additional erosion control measures required due to irrigation operations programmed by the contractor that did not take into account cycle and soak functions of the controller will be installed and/or repaired as directed by the landscape architect and/or owner's representative at no additional cost to the owner.
- F. Mulch replenishment
  1. Contractor to replenish mulch levels as required to match installation levels with the same type as listed in the documents

#### **1.09 PROTECTION**

- A. Maintain all planting areas from time of plant installation, through the Plant Establishment Period and final acceptance, in accordance with Standard Specifications.
- B. Maintain weed levels to less than 5% of total area with a final goal of less than 3% at completion of the establishment period.
- C. Maintenance also includes temporary fences, barriers, and signs as required for protection.
- D. The Contractor shall treat or replace any plant that becomes damaged, fall in decline or be injured, as directed by the Owner's Representative at no additional cost to the Owner.

- E. The Contractor shall be responsible for protecting the health and function of the soil including;
  - 1. Maintaining mulch cover
    - a. Using powered blowers in mulched areas is prohibited.
  - 2. Stripping soil cover and exposing soil is prohibited.
  - 3. Allowing soil to dry out or over watering causing an anaerobic conditions.
  - 4. Compaction of soil due to equipment is prohibited.

If any of the above issues develop or occur during the maintenance period the contractor shall be responsible to correct in full at no cost to the owner, this shall include soil tillage, de-compaction, adding additional amendments, replacing mulch, and removal and replacement of damage soil if mitigation is not feasible.

#### **1.10 FERTILIZATION**

- A. Groundcover and all planting shall be fertilized in accordance with soils report recommendations when granular fertilization is used; if no soils report exists, the following criteria shall prevail: apply certified organic compost mulch at the rate of 3 cu yards per 1000 square feet 30 days after installation. Repeat application every 60 days if maintenance period is longer than 90 days. Organic Compost shall be Custom Amendment Mix (WCP 33) by Earthworks Soil Amendments, Inc., 951-782-0260.

#### **PART 2 - PRODUCTS**

Not used.

#### **PART 3 - EXECUTION**

##### **3.01 FIELD QUALITY CONTROL**

- A. Perform Site Observations: For the purpose of establishing the 90-day Maintenance Period and observing completion of the work of this Section through final acceptance. A minimum of (6) six separate field visits, occurring chronologically as follows:
  - 1. Observation for Maintenance at Commencement
  - 2. 15-day Progress Maintenance Observation
  - 3. 30-day Progress Maintenance Observation
  - 4. 60-day Coordinate Site Meeting with Client's Site Maintenance Staff
  - 5. 60-day Progress Maintenance Observation
  - 6. 90-day Observation for Final Acceptance
- B. Observation for Plant Establishment Period Commencement: Request observation and acceptance by Owner's Representative after all plant material is installed and after all irrigation work and other work of this Section is completed. Plant Establishment Period shall begin upon acceptance of final planting and review by the Owner's Representative. The Period shall continue for a minimum of 90-calendar days until Final Acceptance.

- C. At any time, deficiencies are found such as underperforming plants or a lack of maintenance, the Owner's Representative will notify the Contractor immediately that the 90-day period has been suspended until such time as the deficiencies are fully corrected.
- D. The Contractor has 3 days to respond to any notices of deficiencies and make appropriate corrections including plant replacements.

### **3.02 PROGRESS MAINTENANCE OBSERVATION**

- A. General: Notify the Owner's Representative 72 hours prior to a required scheduled Progress Maintenance Observation. All items determined to be deficient during the previous observation shall be completed prior to the meeting. FAILURE TO DO SO MAY RESULT IN AN EXTENSION OF THE PLANT ESTABLISHMENT and MAINTENANCE PERIOD. In addition, prior to first Progress Maintenance observation, furnish the Owner's Representative with the following information:
  - 1. An "As-Built" irrigation plan, as specified.
  - 2. All supplier invoices for the nursery stock, commercial fertilizers, soil amendments, mulches and herbicides as shown and specified and as installed.
  - 3. Maintenance schedule for fertilization, irrigation, and for all planting areas.
- B. Failure to provide the above submittals may result in the re-scheduling of the Progress Maintenance Observations and extend the Maintenance Period.
- C. Notify the Owner's Representative in writing, prior to any of the Progress Maintenance Observations of any conditions, which may impede proper plant establishment and or growth.
- D. Final Maintenance Observation: Notify the Owner's Representative at least 7 days before the expiration of the Plant Establishment Period for Final Maintenance Observation. Prior to this observation, all items determined to be deficient during the Progress Maintenance Observations shall be completed and signed-off by the Owner's Representative.

### **3.03 FINAL COMPLETION**

- A. General: Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work of this Section, Section 32 90 00 Planting, and Section 32 84 00 Planting Irrigation, including 90-Day Plant Establishment Period, exclusive of replacement of plant material under the terms of the Warranty.
- B. Termination of Observation: During any Observations, any landscape item previously identified as deficient in the Progress Maintenance Observations and determined by the Owner's Representative to be still deficient, shall automatically terminate the Final Completion and result in the extension of the Plant Establishment Period an additional 30 days. Additional costs associated with subsequent Observations that are a result of the Contractor's failure to correct deficient items shall be paid by the Contractor. There shall be no conditional final completion agreement for any work.

### **3.04 NOTIFICATION TO OWNER FOR TRANSFER OF MAINTENANCE**

- A. At least one month prior to the end of the 90-Day "Plant Establishment Period," the Contractor shall notify the Owner's Representative to coordinate a meeting between the Recreation & Park Department staff and the Contractor to ensure a smooth transition for turn-over of plant maintenance.

END OF SECTION

## **SECTION 33 42 11 STORMWATER GRAVITY PIPING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Stormwater drainage piping.
- B. Stormwater pipe accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.
- B. Section 31 23 16 - Excavation: Excavating of trenches.
- C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 23 23 - Fill: Bedding and backfilling.
- E. Section 33 42 30 - Stormwater Drains.

#### **1.03 REFERENCE STANDARDS**

- A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Pipe, 75- to 250-mm (3- to 10-in.) Diameter.
- B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
- C. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- D. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- E. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- F. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the installation of stormwater gravity piping with size, location and installation of stormwater drains according to Section 33 42 30.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- E. Field Quality Control Submittals: Document results of field quality control testing.
- F. Project Record Documents:
  - 1. Submit documents under provisions of Section 01 78 00 - Closeout Submittals.
  - 2. Record location of pipe runs, connections, and invert elevations.
  - 3. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with applicable code for materials and installation of the Work of this section.
  - 1. Conform to requirements of California Plumbing Code and Authorities Having Jurisdiction.
- B. Utility Compliance: Comply with local utility regulations and standards pertaining to storm drainage systems.
- C. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm drainage systems.

### **2.02 STORMWATER PIPE MATERIALS**

- A. Provide products that comply with applicable code(s).
- B. Plastic Pipe: ASTM D3034, Type PSM, Poly Vinyl Chloride (PVC) material; inside nominal diameter of 4 to 15 inches, bell and spigot style solvent sealed joint end.
  - 1. SDR 35, unless indicated otherwise on Drawings.
- C. Plastic Pipe: ASTM D3350, High Density Polyethylene (HDPE) corrugated wall pipe with integrally formed smooth liner; inside nominal diameter of 4 inch, meeting the requirements of AASHTO M 252, Type S, for diameters between 3 inches and 10 inches and AASHTO M 294, Type S, for diameters between 12 inches and 60 inches, soil-tight, bell and spigot joints with rubber gaskets, with pipe and fittings manufactured from virgin PE compounds with cell classification 3254420C.
  - 1. Basis of Design Product: N-12 as manufactured by ADS, or approved equal.

### **2.03 PIPE ACCESSORIES**

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal, Water Tight.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. Filter Fabric: Non-biodegradable, non-woven , AASHTO M288 Class 2. Provide Geosynthetics 315ST manufactured by ADS Advanced Drainage Systems, Inc.; [www.ads-pipe.com](http://www.ads-pipe.com) .
- D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Drain" in large letters.

## **2.04 BEDDING AND COVER MATERIALS**

- A. Bedding: As specified in Section 31 23 16.13.
- B. Cover: As specified in Section 31 23 16.13.

## **PART 3 EXECUTION**

### **3.01 TRENCHING**

- A. See Section 31 23 16.13 - Trenching for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

### **3.02 CLOSING ABANDONED STORM DRAINAGE SYSTEM**

- A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.
  - 1. Close open ends of concrete or masonry utilities with not less than 8 inch thick brick masonry bulkheads.
  - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.
- B. Abandoned Structures: Remove structure and close open ends of the remaining piping, or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining and fill concrete.

### **3.03 INSTALLATION**

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.
  - 1. Install in accordance with SSPWC (Greenbook), local standards and soils report.
  - 2. Install pipe, fittings and accessories in accordance with ASTM D3034 and manufacturer's instructions. Seal joints watertight.
- C. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
  - 1. Plastic Pipe: Also comply with ASTM D2321.
- D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

1. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements.
2. Use fittings for branch connections, except where direct tap into existing sewer or manhole is indicated.
3. Use proper size increasers and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
4. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.
  - a. Place bell ends of piping facing upstream.
5. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.
- E. Connect to building storm drainage system, foundation drainage system, and utility/municipal system.
- F. Make connections through walls through sleeved openings, where provided.
- G. Install continuous trace wire 6 inches above top of pipe; coordinate with Section 31 23 16.13.

#### **3.04 TAP CONNECTIONS**

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.
- B. 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 6 inch overlap, with not less than 6 inches of 3000 psi 28-day compressive-strength concrete.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

#### **3.05 FIELD QUALITY CONTROL**

- A. Perform field inspection in accordance with Section 01 40 00 - Quality Requirements.
  1. Perform testing of completed site piping in accordance with the Plumbing Code using water or air pressure test.
- B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
  1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
  2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.
  3. Perform video inspection of all piping prior to final acceptance of work.
    - a. All video operations shall be recorded digitally for playback if required.



- b. All video inspections will include a detailed narrative identifying exact locations of the installed lines and limits of areas to be re-installed.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

### **3.06 PROTECTION**

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**

## **SECTION 33 42 30 STORMWATER DRAINS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Precast concrete catch basins.
- B. Cast-in-place concrete catch basins.
- C. Cast-in-place concrete base pad.
- D. Prefabricated trench drains.
- E. Frames and grates.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 31 23 16 - Excavation.
- C. Section 31 23 23 - Fill.
- D. Section 33 42 11 - Stormwater Gravity Piping.

#### **1.03 REFERENCE STANDARDS**

- A. AASHTO HB - Standard Specifications for Highway Bridges.
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
- C. ACI 301 - Specifications for Concrete Construction.
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- E. ACI 305R - Guide to Hot Weather Concreting.
- F. ACI 306R - Guide to Cold Weather Concreting.
- G. ACI 318 - Building Code Requirements for Structural Concrete.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- J. ASTM C150/C150M - Standard Specification for Portland Cement.
- K. ASTM C478/C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
- L. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- M. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.
- N. CBC Ch. 11B - California Building Code-Chapter 11B.
- O. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Installation of stormwater drains with piping and other structures.
  - 1. See Section 33 42 11 for stormwater gravity piping.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Weight rating for catch basins and frame and grates.
- C. Shop Drawings: Indicate stack assembly, invert elevations, opening sizes, and pipe angles.
- D. Manufacturer's Installation Instructions: Indicate special procedures for assembly.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- H. Field Quality Control Submittals: Document results of field quality control testing.
- I. Project Record Documents:
  - 1. Record invert elevations of catch basins and trench drains.
  - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least three years of documented experience.
- C. Documents at Project Site: Maintain one copy of manufacturer's instructions, assembly drawings, and shop drawings at the project site.
- D. Perform work of this section in accordance with ACI 301 and ACI 318.
  - 1. Maintain one copy of each document on site.
- E. Follow recommendations of ACI 305R when concreting during hot weather.
- F. Follow recommendations of ACI 306R when concreting during cold weather.

### **PART 2 PRODUCTS**

#### **2.01 CATCH BASINS**

- A. Weight Rating: H 20 according to AASHTO HB.
- B. Precast Concrete Catch Basins: Comply with ASTM C478/C478M, reinforced.
  - 1. Wall Thickness: Manufacturer's standard.

2. Precast Base Thickness: 2 inches Manufacturer's standard.
3. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
4. Joint Sealant: Comply with ASTM C990.
5. Manufacturers:
  - a. Brooks Products; XXXX CB Series: [www.brooksproductsnw.com](http://www.brooksproductsnw.com).
  - b. J&R Concrete Products; CBXXXX Series: [www.jrconcreteproducts.com](http://www.jrconcreteproducts.com).
  - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cast-In-Place Concrete Catch Basins: Comply with ASTM C94/C94M, reinforced.
  1. Wall Thickness: 6 inches (152 mm).
- D. Cast-In-Place Concrete Base Pads: Comply with ASTM C94/C94M, reinforced.
  1. Thickness: 12 inches.
  2. Width: Match outside catch basin diameter.
  3. Length: Match outside catch basin diameter.
- E. Cast-In-Place Concrete Materials:
  1. Cement: ASTM C150/C150M, Type II.
  2. Sand: ASTM C33/C33M, fine aggregate.
  3. Crushed Gravel: ASTM C33/C33M, coarse aggregate.
  4. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
  5. Water: Potable.
  6. Form Materials: Wood, profiled to suit conditions.
- F. Frames and Grates: Cast iron, pattern as indicated.

## **2.02 CATCH BASIN, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS**

- A. Lids and Drain Covers: Cast iron, hinged to cast iron frame, lockable and extra heavy duty proof load.
  1. At pedestrian areas provide ADA Standards and CBC Ch. 11B compliant grates with maximum 1/2 inch wide openings. Place linear openings perpendicular to path of travel.
  2. Catch Basin:
    - a. Lid Design: Linear grill.
    - b. Nominal Lid and Frame Size: As indicated on Drawings
  3. Cleanout:
    - a. Lid Design: Checkerboard grill.
    - b. Nominal Lid and Frame Size: As indicated on Drawings
  4. Area Drain:
    - a. Lid Design: Linear grill.
    - b. Nominal Lid and Frame Size: As indicated on Drawings

5. Trench Drain:
  - a. Lid Design: Linear grill.
  - b. Nominal Lid and Frame Size: As indicated on Drawings
6. Landscape Drain:
  - a. Lid Design: As indicated on Drawings.
  - b. Nominal Lid and Frame Size: As indicated on Drawings.
  - c. Atrium Grate: Raised dome type, HDPE or Polyethylene with UV inhibitor.
    - 1) Manufacturers:
      - (a) ADS; Atrium Grate: [www.adspipe.com](http://www.adspipe.com).
      - (b) Brooks Products; Atrium Grate: [www.brooksproductsnw.com](http://www.brooksproductsnw.com).
      - (c) NDS Products; Atrium Grate: [www.ndspro.com](http://www.ndspro.com).
      - (d) Substitutions: See Section 01 60 00 - Product Requirements.

### **2.03 PREFABRICATED TRENCH DRAINS**

- A. Prefabricated Trench Drain: Polymer concrete, metal installation brackets.
  1. Weight Rating: H 15 according to AASHTO HB.
  2. Bottom: Sloped.
  3. Ultraviolet Exposure: 10 years minimum, ASTM G154.
  4. Frames and Grates: Galvanized steel support, galvanized steel grate, linear pattern, match drain opening size.
    - a. At pedestrian areas provide ADA Standards and CBC Ch. 11B compliant grates with maximum 1/2 inch wide openings. Place linear openings perpendicular to path of travel.
  5. Products:
    - a. Basis of Design: ACO Polymer Products, Inc., See Civil Drawings.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.04 ACCESSORIES**

- A. Sediment Filter: Provide sediment filter compliant with BMP practice for EPA (NPDES) II, as indicated on Drawings.
  1. Product: Storm Water Sediment Control Grate Insert manufactured by Transpo Industries, Inc.: [www.transpo.com](http://www.transpo.com)
- B. Geotextile Filter Fabric:
  1. Non-biodegradable, non-woven, AASHTO M 288, Class 2.
  2. Provide Geosynthetics 601T manufactured by ADS Advanced Drainage Systems, Inc.; [www.ads-pipe.com](http://www.ads-pipe.com)., or equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify items provided by other sections of work are properly sized and located.
- B. Verify built-in items are in proper location and ready for roughing into work.
- C. Verify excavation location and depth are correct.

### **3.02 EXCAVATION AND FILL**

- A. Hand trim excavation for accurate placement to indicated elevations.
- B. Backfill with cover fill, tamp in place and compact, then complete backfilling.
- C. Cover weep holes with 3/4 inch (19 mm) crushed stone.
- D. See Section 31 23 16 for additional excavation requirements.
- E. See Section 31 23 23 for additional fill requirements.

### **3.03 INSTALLATION**

- A. Establish elevations and pipe inverts for inlets and outlets as indicated in drawings.
- B. Concrete Mixing:
  - 1. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
  - 2. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- C. Precast Concrete Catch Basins:
  - 1. Place base section plumb and level.
  - 2. Install joint sealant uniformly around section lip.
  - 3. Overlay additional sections on joint sealant.
  - 4. Install cone or lid plumb and level on joint sealant.
- D. Cast-In-Place Concrete Base Pad:
  - 1. Form base pad according to Section 03 30 00.
  - 2. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
  - 3. Place concrete in accordance with ACI 304R.
  - 4. Float base pad top surface level.
- E. Cast-In-Place Concrete Catch Basins:
  - 1. Form catch basin according to Section 03 30 00.
  - 2. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
  - 3. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
  - 4. Place concrete in accordance with ACI 304R.
  - 5. Float catch basin top surface level.

F. Prefabricated Drop Inlets or Trench Drains:

1. Place base section plumb and level.
2. Install according to manufacturer's instructions.
3. Secure installation brackets.

G. Grade Adjustments:

1. Place adjacent materials tight and smooth following design grades.

H. Frames and Grates:

1. Place frame plumb and level.
2. Mount frame on prefabricated drop inlets or trench drains according to manufacturer's instructions.
3. Place grate in frame securely.

**3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field inspection for pipe invert elevations.
- C. If inspections indicate work does not meet specified requirements, adjust work and reinspect at no cost to Owner.

**END OF SECTION**