

PROJECT MANUAL

NEW KITCHEN & WEIGHT ROOM

GROSSMONT UNION HIGH SCHOOL DISTRICT

SPRING VALLEY, CA

CONSTRUCTION DOCUMENTS

VOLUME 1 OF 1 Divisions 00 - 33

DSA Application #04-120895

File #37-H4

1.30.55

June 2022

**SECTION 00 01 01
PROJECT TITLE PAGE**

PROJECT MANUAL

FOR

NEW KITCHEN & WEIGHT ROOM

PROJECT NUMBER: 1-30-55

GROSSMONT UNION HIGH SCHOOL DISTRICT

1100 MURRAY DRIVE, EL CAJON, CA 91944

WWW.GUHSD.NET

PROJECT LOCATION

GROSSMONT HIGH SCHOOL

1100 MURRAY AVENUE

EL CAJON , CALIFORNIA 92020

PREPARED BY:

ARCHITECT

RUHNAU CLARKE ARCHITECTS

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

951.684.4664 - 760.438.5899

www.ruhnaucclarke.com

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Project Title Page 00 01 01 - 1
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NOTICE: This Project Manual, is an unpublished instrument of service of the authors.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).

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**SECTION 00 01 02
PROJECT INFORMATION**

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: New Kitchen & Weight Room, located at:
Project Number: 1-30-55.
Grossmont High School.
1100 Murray Avenue.
El Cajon, California 92020.
- B. The Owner, hereinafter referred to as District: Grossmont Union High School District
Grossmont Union High School District
1100 Murray Drive, El Cajon, CA 91944
www.guhsd.net
619.644.8000

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: modernization and related site improvements.
- B. Contract Scope: Construction, demolition, and renovation.
- 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 California 92501 - 5751 Palmer Way, Suite C, Carlsbad
California 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 District reserves the right to change the schedule or terminate the entire procurement process at any time.

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1.06 PROCUREMENT DOCUMENTS

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

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Project Information 00 01 02 - 2
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IDENTIFICATION STAMP
 DIV. OF THE STATE ARCHITECT

APP: 04-120895 INC:
 REVIEWED FOR
 SS FLS ACS

DATE: 06/27/2022

**SECTION 00 01 07
 SEALS PAGE**

ARCHITECT OF RECORD (AOR)

RUHNAU CLARKE ARCHITECTS

5751 Palmer Way, Suite C, Carlsbad, California 92010
 Roger Clarke, Architect of Record C-21340



STRUCTURAL ENGINEER OF RECORD (SEOR)

KNA CONSULTING ENGINEERS, INC.

9931 Muirlands Blvd., Irvine, CA 92618
 Larry Kaprielian S-2795



MECHANICAL ENGINEER OF RECORD (MEOR)

MA ENGINEERS

5160 Carroll Canyon Road, Suite 200, San Diego CA 92121
 Roy C. Campbell M-025911



ELECTRICAL ENGINEER OF RECORD (EOR)

JOHNSON CONSULTING ENGINEERS, INC.

12875 Brookprinter Place, #300, Poway CA 92064
 Monica Goese-Hansen E-14781



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CIVIL ENGINEER OF RECORD (CEOR)

CROSS CIVIL ENGINEERING

4653 Carmel Mountain Rd. Suite 308, San Diego CA 92130
Jeff Reno Cross RCE-67530



LANDSCAPE ARCHITECT OF RECORD (LAOR)

MM+LA ASSOCIATES

1982 White Birch Drive, Vista CA 92081
Brandt Maughan LA-1870



END OF SEALS PAGE

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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: Entitled Geotechnical Investigation, New Kitchen and Weight Room Modernization Project, Grossmont High School, 1100 Murray Drive, El Cajon, California, dated January 10, 2022; Project Number 12429.018.
 - 1. Original copy is available for inspection at District'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 District, Architect and Engineers disclaim all responsibility for the accuracy of information prepared by others.
 - 1) The District, 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 District, 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.
 - 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 District.
 - a. If variances from Geotechnical Report are found, make written report to Construction Manager.
 - b. Claims for conditions found to be not as indicated in soil investigation data not permitted, unless otherwise indicated in District-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

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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 Construction Manager 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 Construction Manager.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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**SECTION 00 40 25
REQUEST FOR INFORMATION**

RFI NUMBER: _____

DATE: _____

PROJECT NAME: NEW KITCHEN & WEIGHT ROOM

PROJECT NO.: 1-30-55

TO: RUHNAU CLARKE ARCHITECTS

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

Attention: _____

Contractor: _____

Address: _____

Request By: _____

Date: _____

BRIEF SUMMARY OF RFI: _____

Drawing No. _____ Detail No. _____

Specification Section _____ Title _____

Page _____ Paragraph _____

DETAILS OF THIS RFI: _____

Attachments: _____

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Request for Information 00 40 25 - 1
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RESPONSE WILL BE INCLUDED IN AN ADDENDUM

END OF RFI

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**SECTION 00 43 25
SUBSTITUTION REQUEST FORM - DURING PROCUREMENT**

SUBSTITUTION REQUEST NO. _____

DATE: _____

PROJECT NAME: NEW KITCHEN & WEIGHT ROOM

PROJECT NUMBER: 1-30-55

TO: RUHNAU CLARKE ARCHITECTS

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

From: _____

We hereby submit for your consideration the following product comparisons of the specified product and the proposed substitution. The undersigned fully understands that failure to answer any item below may be cause for rejection of request for substitution.

Request for substitution shall only be made during bidding (not later than 7 days prior to bid opening for inclusion by Addendum) except under conditions beyond control of Contractor.

SPECIFIED PRODUCT: _____

Project Manual Section Title _____ Number ___ Page ___ Paragraph ___.

Drawing No. _____ Detail No. _____

Proposed Substitution: _____

Manufacturer: _____ Tel: _____

A. Is the point-by-point comparative data attached? — REQUIRED BY A/E

B. Reason request for substitution is being submitted: _____

DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT

C. Does proposed substitution affect in any way the Structural Safety, Access Compliance, or Fire & Life Safety portions of the project? No__ Yes__

Explain _____

D. Does proposed substitution affect dimensions, gages, weights, etc. on Drawing? No__ Yes__

Explain _____

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- E. Does proposed substitution require changes in Drawings or design and installation changes?
 No ___ Yes ___ _____
 (If yes, cost of these changes is the responsibility of the Contractor.)
- F. Does proposed substitution affect product cost, delivery time, or construction schedule?
 No ___ Yes ___ Explain _____
- G. Does proposed substitution comply with specified ICC Number, UL Rating, ASTM Numbers?
 No ___ Yes ___ Explain _____
- H. Does proposed substitution affect other trades and systems such as wiring, piping, ductwork, structure, etc.? No ___ Yes ___ (Explain which and how) _____

- I. Does proposed substitution product guarantee differ from that of the specified product?
 No ___ Yes ___ Explain _____

Attach a listing of 3 similar projects (one in service for at least 3 years) using the proposed substitution.

Substantiating Data: Attach product data/brochures and Vendor qualifications for both specified and substitute product. Provide samples for both specified and substitute products, if applicable.

Certification: Undersigned has examined Construction Documents, is familiar with specified product, understands indicated application of product, and understands design intent of the Architect caused by the requested substitution.

Submitted by: _____
 .(Type Name) Signature Date

Signature must be made by person having legal authority to bind his firm to the above terms.

END OF SECTION

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Substitution Request Form - During Procurement 00 43 25 - 2
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**SECTION 00 63 25
SUBSTITUTION REQUEST FORM - DURING CONSTRUCTION**

SUBSTITUTION REQUEST NO. _____

DATE: _____

PROJECT NAME: NEW KITCHEN & WEIGHT ROOM

PROJECT NUMBER: 1-30-55

TO: RUHNAU CLARKE ARCHITECTS

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

From: _____

We hereby submit for your consideration the following product comparisons of the specified product and the proposed substitution. The undersigned fully understands that failure to answer any item below may be cause for rejection of request for substitution.

This request for substitution form shall only be used after the end of the bidding period except under conditions beyond control of Contractor.

Specified Product: _____

Project Manual Section Title _____ Number ___ Page ___ Paragraph ___.

Drawing No. _____ Detail No. _____

Proposed Substitution: _____

Manufacturer: _____ Tel: _____

A. Reason request for substitution is being submitted: _____

B. Does proposed substitution affect in any way the Structural Safety, Access Compliance, or Fire & Life Safety portions of the project? No__ Yes__

Explain _____

C. Does proposed substitution affect dimensions, gages, weights, etc. on Drawing? No__ Yes__

Explain _____

D. Does proposed substitution require changes in Drawings or design and installation changes?

No__ Yes__ _____

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(If yes, cost of Architect and Engineer document changes are the responsibility of the Contractor.)

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- E. Does proposed substitution affect product cost, delivery time, or construction schedule?
No ___ Yes ___ Explain _____
- F. Does proposed substitution comply with specified ICC Number, UL Rating, ASTM Numbers?
No ___ Yes ___ Explain _____
- G. Does proposed substitution affect other trades and systems such as wiring, piping, ductwork, structure, etc.? No ___ Yes ___ (Explain which and how) _____

If yes, has impact on their work been included in price of proposed substitution? No ___ Yes ___.

- H. Does proposed substitution product guarantee differ from that of the specified product?
No ___ Yes ___ Explain _____

If the substitution request is accepted, it will result in:

No cost impact ___ Improve Schedule ___ Credit of \$ _____

Attach a listing of 3 projects (one in service for at least 3 years) using the proposed substitution.

Substantiating Data: Attach product data/brochures and Vendor qualifications for both specified and substitute product. Provide samples for both specified and substitute products, if applicable.

Certification: Undersigned has examined Construction Documents, is familiar with specified product, understands indicated application of product, and understands design intent of the Architect caused by the requested substitution.

Submitted by: _____
 .(Type Name) Signature Date

Signature must be made by person having legal authority to bind his firm to the above terms.

Architect's Comments:

___ Accepted, ___ accepted as noted, ___ not accepted, ___ received too late.

Reviewed by:

Architect	Date
DSA	Date
District	Date

END OF SECTION

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**SECTION 01 10 00
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: New Kitchen & Weight Room
- B. District's Name: Grossmont Union High School District.
- C. Architect's Name: Ruhnau Clarke Architects.
- D. The Project consists of the construction of two new single story Type V-B buildings and related site work located at Grossmont High School.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract 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 Assembly Group A-2, Business Group B, and Educational Group E, Construction Type V-B, , totaling approximately 10,940 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.

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Summary 01 10 00 - 1
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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: District 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. District 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 District.

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- B. Items noted NIC (Not in Contract) will be supplied and installed by District before Substantial Completion. Some items include:
 - 1. Movable cabinets.
 - 2. Furnishings.
 - 3. Small equipment.
 - 4. Rugs.
 - 5. Artwork.
- C. District will supply the following for installation by Contractor:
 - 1. Owner-Furnished Products: District 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. District 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. District will pay all assessments and utility service connection fees. Costs of assessments shall not be included in the Contract Sum.

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- 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. District 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. District intends to continue to occupy adjacent portions of the existing site during the entire construction period.
- B. District intends to occupy the Project upon Substantial Completion.
- C. Cooperate with District to minimize conflict and to facilitate District's operations.
- D. Schedule the Work to accommodate District 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. District occupancy.
 2. Work by Others.
 3. Work by District.
 4. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by District:
 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 District.
 - c. Do not restrict access to adjacent properties and do not restrict access for those performing work under separate contracts for the District.
 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.

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- 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 District 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.

1.09 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS

- A. Unless otherwise noted, all provisions of the sections listed below apply to all contracts. Specific items of work listed under individual contract descriptions constitute exceptions.
- B. Section 01 20 00 - Price and Payment Procedures.
- C. Section 01 30 00 - Administrative Requirements.
- D. Section 01 31 14 - Facility Services Coordination.
- E. Section 01 32 16 - Construction Progress Schedule.
- F. Section 01 35 53 - Security Procedures.
- G. Section 01 40 00 - Quality Requirements.
- H. Section 01 42 19 - Reference Standards.
- I. Section 01 50 00 - Temporary Facilities and Controls.
- J. Section 01 51 00 - Temporary Utilities.
- K. Section 01 52 13 - Field Offices and Sheds.
- L. Section 01 55 00 - Vehicular Access and Parking.
- M. Section 01 58 13 - Temporary Project Signage.
- N. Section 01 60 00 - Product Requirements.
- O. Section 01 70 00 - Execution and Closeout Requirements.
- P. Section 01 78 00 - Closeout Submittals.

END OF SECTION

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**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 after this section.
- B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.
 - 1. Submit schedule in a spreadsheet calculated format, such as Excel, based upon the attached Schedule of Values augmented by the Table of Contents of this Project Manual.
- C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification section. Identify site mobilization, bonds and insurance, and record drawings .
- D. Where work is separated into phases requiring separately phased payments, provide separate schedule for each phase.
- E. Where work involves multiple sites and/or "A" number, provide separate schedules for each site and/or "A" number.
- F. Where scope of work involves multiples buildings/structures, provide separate schedule for each building.
- G. Include in each line item, the amount of Allowances specified in this section.
- H. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- I. 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.

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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 District 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 30 00.
 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 District and shall be completed in accordance with directions provided.
 5. Project record documents as specified in Section 01 78 00, for review by District which will be returned to the Contractor.
 6. Affidavits attesting to off-site stored products.

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- 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 DSA 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 DSA.
 - 3. Revisions to Addenda, when approved by DSA, 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 District.
- 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. DSA Construction Change Document approval for substitutions and changes to structural, accessibility, or fire-life-safety portions of approved Drawings and Specifications is required from DSA 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:

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- a. Architect of Record.
 - b. Division of the State Architect 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 District 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 Directive approval is required from DSA prior to installation.
 - 4. Construction Change Directives: In accordance with provisions of the Conditions of the Contract, the District 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 District 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 District'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.

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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 District 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 District and Architect to evaluate and substantiate proposed costs and time for the change in the Work.

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- 4) When District 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) District 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 District and Architect will review the response.
- 1. The District 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 District, with supplementary documents as necessary to describe the change and the associated costs and schedule impacts.
 - 2. Construction Change Document approval is required from DSA prior to fabrication and installation.
 - 3. Submit Contract Change Orders to District through the Architect.
 - 4. Contractor shall prepare and submit five original sets of documents for each Change Order. District, Architect and DSA 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 DSA 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.

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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

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**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

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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 District 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 District'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.

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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 District.
 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 District 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.

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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) District'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 District and by others under separate Contract with District, that will be necessary if the proposed substitution is accepted.
 - d. Impact of Substitution:

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- 1) Savings to District 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 District or for work under separate contract by District.
- 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. Submittal Time Restrictions:
 - 1. District will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.
- B. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
- C. 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 District .
- D. 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 District.
 - 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.

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- 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 District, 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 District 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. District's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
 - b. Other construction by District.
 - 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 District who is the responsible design professional, as approved in advance by District.
- B. Services of Architect or other consultant of the District, 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 District.
- C. Costs of services by Architect or other responsible design professional of the District 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

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billing.

- D. Such fees shall be paid whether or not the proposed substitution or alternative sequence or method of construction is ultimately accepted by District 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 District.
- 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. District will then pay Architect or other consultant of the District.
- G. Certain substitutions require approval from DSA.
 - 1. Substitutions affecting DSA-regulated items shall be considered as construction change documents (CCD's) and shall be approved by DSA prior to construction per DSA IR A-6 and Section 338(c) Part 1, Title 24 CCR. See Section 01 20 00 - Price and Payment Procedures.

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

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**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. Contractor's daily reports.
- G. Progress photographs.
- H. Coordination drawings.
- I. Submittals for review, information, and project closeout.
- J. Number of copies of submittals.
- K. Requests for Interpretation or Information (RFI) procedures.
- L. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: General product requirements.
- B. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.
- D. 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.
- E. 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 Construction Manager and Architect or other responsible design professional.

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- B. Informational Submittals: Written information that does not require responsive action by Construction Manager 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. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
 - 2. Requests for substitution.

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

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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, or Bluebeam PDF Revu, 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.
 2. Other Service acceptable to both District 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 District 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 District.

3.02 PRECONSTRUCTION MEETING

- A. District will schedule a meeting after Notice of Award.
- B. Attendance Required:
1. District.
 2. Architect.
 3. Contractor.
 4. Construction Manager.
- C. Agenda:
1. Execution of District-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.

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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 Architect.
 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, District, 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. District.
 3. Architect.
 4. Construction Manager.
 5. Special consultants.
 6. Contractor's superintendent.
 7. Major subcontractors.
 8. Inspector of Record.
 9. DSA Field Representative.
- C. Agenda:
1. Designation of Key Personnel: Contractor shall designate key personnel and provide a name and address list which includes the following:
 - a. Contractor: Project Manager and Superintendent.
 - b. Major subcontractors: Principal/Project Manager and Superintendent.
 - c. Major materials suppliers: Contact person.
 2. Distribute and discuss list of subcontractors and suppliers.
 3. 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.
 4. 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.

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5. Use of premises by District and Contractor.
 - 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 District's requirements for use of premises.
6. District's requirements.
7. Construction facilities and controls provided by District.
8. Temporary utilities provided by District.
9. Survey and building layout.
10. Security and housekeeping procedures.
11. Schedules.
 - a. Distribute and discuss initial construction schedule and critical work sequencing of major elements of Work;
 - b. Include coordination of District Furnished / Contractor Installed (OFCl) products;
 - c. Work under separate contracts by serving utility agencies;
 - d. Work under separate contracts by companies and District.
12. Review requirements for Contractor's coordination of Work; review sequence and schedule for work being performed for District under separate contracts.
13. Submittals Administration: Review administrative procedures for shop drawings, product data and samples submittals and review of preliminary Submittals Schedule.
14. Materials and Equipment:
 - a. Review substitution requirements;
 - b. Review schedule for major equipment purchases and deliveries;
 - c. Review materials and equipment to be provided by District (OFCl products).
15. Permits and Fees: Review Contract requirements and review schedule and process for obtaining permits and paying fees.
16. Application for payment procedures.
17. Procedures for testing.
 - a. Review tests and inspections to be performed by the following:
 - 1) Independent testing and inspection agency.
 - 2) Manufacturers and installers.
 - 3) Serving utilities and public agencies.
 - 4) Authorities having jurisdiction.
18. Procedures for maintaining record documents.
19. Requirements for start-up of equipment.
 - a. Operation and Maintenance Data:

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- 1) Format and content of operation and maintenance manuals; instruction of District's personnel.
- 20. 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, District, 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. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Meeting Time and Location: As mutually agreed by District, Architect, and Contractor, at on-site location.
- D. Special Meetings: As necessary, Construction Manager 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.
- E. Attendance Required:
 - 1. Contractor.
 - 2. District.
 - 3. Architect.
 - 4. Construction Manager.
 - 5. Contractor's superintendent.
 - 6. Major subcontractors.
 - 7. Inspector of Record.
- F. Agenda:
 - 1. Review minutes of previous meetings.
 - a. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
 - b. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
 - c. Challenge to minutes shall be settled as priority portions of "old business" at the next regularly scheduled meeting.
 - 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.

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

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. Contractor's Review: All schedules shall be reviewed and approved by Contractor prior to submission for Architect's and District's review.
- C. Reviews by Architect and District 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. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- E. 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.
- F. Within 10 days after joint review, submit complete schedule.
- G. Submit updated schedule with each Application for Payment.

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 District and Architect, submit two printed copies at weekly intervals.
 1. Submit in format acceptable to District.
 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.

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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 District 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:

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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. 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.

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- 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 District.
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.

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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 District 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. District'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.

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- 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 District.
 - 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.

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- 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.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
 - b. Allow time for shipping and distribution to involved parties. Minimum 1 day, including those sent by electronic transmission.
- 6. Posting: Post one copy of most recent Submittals Schedule in Contractor's field office, readily available to District, Construction Manager, and Architect. Update bi-weekly with project schedule.
- 7. Archive: Preserve a minimum of two copies of all superseded schedules, with one copy available at field office for review by District or Architect.

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.

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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 District.

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 District'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.

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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 District 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.

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- 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, District, 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.

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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", "Reviewed", 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", "Reviewed 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.

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- 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

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**SECTION 01 30 00.01
REQUEST FOR INTERPRETATION**

RFI NUMBER: _____ **DATE:** _____

PROJECT NAME: NEW KITCHEN & WEIGHT ROOM **PROJECT NO.: 1-30-55**

TO: RUHNAU CLARKE ARCHITECTS

3775 Tenth Street, Riverside California 92501 - 5751 Palmer Way, Suite C, Carlsbad California 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: _____

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Response By: _____

Date:

Organization: _____

Copies: File District Structural Mechanical Plumbing Electrical
 Civil Landscape other consultants

END OF RFI

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SUBMITTAL / SHOP DRAWING TRANSMITTAL

To:	Ruhnau Clarke Architects	Contractor's Submittal No.	
Attn:	Construction Dept.		
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	
<input type="checkbox"/>	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"/>	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.
 - 1. Bi-Weekly BIM coordination meetings.
- 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.

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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 District.
 - 2. Preinstallation Meetings: Coordinate and document work between trades. See Section 01 70 00 - Execution and Closeout Requirements.
 - 3. Cooperate with District, Construction Manager, and others as directed by District 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 District, 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.

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- 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 District, 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.

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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.

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- 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 Construction Manager.
- 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.

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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 District; 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

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**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 Construction Manager'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 Construction Manager 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.

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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 Division 01.
 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. District reserves the right to disapprove Scheduler when submitted by Contractor based on his/or her sole discretion. District 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 Construction Manager: Reviews by Architect and Construction Manager 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 District'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.

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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 30 x 42 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 preliminary network diagram.
- B. Prescheduling Conference:
 - 1. Construction Manager will conduct a conference within fifteen (15) work days after the Notice of Intent to Award.
 - 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 District occupancy.
 - 4) Review delivery dates for District-furnished products.
 - 5) Review schedule for work of District'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 District's IT requirements for installation of their Work.

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- 10) Review time required for Project closeout and District 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 Construction Manager 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.

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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, Construction Manager, and District 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 Construction Manager 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

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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 Construction Manager and Architect.
 8. Actual finish date.
 9. Latest start date.
 10. Latest finish date.
 11. Total and free float; float time shall accrue to District and to District'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 District and Contractor.
 - d. Any delay (including District caused) encountered is to be subtracted from the available days ahead of progress against the Construction Schedule.
 - 1) District 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.

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- 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. Contractor's periodic payment request sorted by Schedule of Values listings.
 4. Listing of activities on the critical path.

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 District.
- 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 District 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.

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- 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 Construction Manager, 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 Construction Manager 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.

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- 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 District 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 District, or events for which the District 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 District-caused or caused by an event which is beyond the control and without the fault or negligence of either the District 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 District 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 Construction Manager 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.

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- 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 District-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 Construction Manager 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.

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1. Include the new Progress Schedule data, if accepted by the District, in the next monthly Schedule Update.
2. When the District 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 Construction Manager may accept as appropriate for such interim purpose.
 - a. It is understood and agreed that any such interim acceptance by the Construction Manager 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 Construction Manager 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, District, 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 Construction Manager 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 Construction Manager or Architect.

3.13 FINAL SCHEDULE SUBMITTAL

- A. The final Schedule Update becomes the Record (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 Record (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

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**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 California 92501 - 5751 Palmer Way, Suite C, Carlsbad California 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.

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Agreement is on next page

HOLD HARMLESS AGREEMENT

ARCHITECT'S PROJECT: NEW KITCHEN & WEIGHT ROOM

ARCHITECT'S PROJECT NUMBER: 1-30-55

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.

Acknowledged by:

Signature of Company Officer Print or Type Name Date

Company Name

Street Address City, State, Zip Code

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E-mail Address

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END OF SECTION

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**SECTION 01 35 53
SECURITY PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: use of premises and occupancy.
- B. Section 01 50 00 - Temporary Facilities and Controls: Temporary lighting.
- C. Protect Work , existing premises and District's operations from theft, vandalism, and unauthorized entry.
- D. Initiate program in coordination with District's existing security system at project mobilization.
- E. Maintain program throughout construction period until District acceptance precludes the need for Contractor security.
- F. Maintain log of workers and visitors, make available to District on request.
- G. District will control entrance of persons and vehicles related to District's operations.
- H. Contractor shall control entrance of persons and vehicles related to District's operations.
- I. Coordinate access of District's personnel to site in coordination with District's security forces.
- J. Shall be worn by Contractor's superintendent and all sub contractors
- K. Provide identification badge to each person authorized to enter premises.
- L. Maintain a list of accredited persons, submit copy to District on request.
- M. Special badges shall be issued to construction personnel when term of construction exceeds six months.
- N. Require return of badges at expiration of their employment on the Work.
- O. Employ uniformed guard service to provide watch persons at site during all non-working hours.
- P. The phone number for security is _____.
- Q. All personnel must obey and act immediately upon any request by security.
- R. In an emergency, from inside the facility, dial _____. Outside the facility, dial 911.
- S. Do not allow cameras on site or photographs taken except by written approval of District.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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**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. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. 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 Division of the State Architect (DSA), 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.

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:

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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 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 District'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 District'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:

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- 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 District'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 District'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 District.
- 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 District.
- 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 District.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications:

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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 Division of the State Architect.
 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. District 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. District's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. District reserves the right to require Contractor to make changes to the plan and operations, including

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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.

1.08 REFERENCES AND STANDARDS - SEE SECTION 01 42 19

1.09 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.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. District 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, District 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. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3740, and DSA.
 - 2. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 3. Laboratory: Authorized to operate in California.
 - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

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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 District.
- K. Verification of Quality: Work shall be subject to verification of quality by District, or Architect in accordance with provisions of the General Conditions of the Contract.
 - 1. Contractor shall cooperate by making Work available for inspection by District, Architect or their designated representatives.
 - 2. Such verification may include mill, plant, shop, or field inspection as required.

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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 District, 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.

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- 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 District'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.

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- 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 District.
- 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.

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- 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.

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- 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 District, shall not relieve the Contractor of the obligation to correct such Work.
 - 1. Acceptance of structurally related non-conforming work shall be submitted to DSA for review and approval.
- E. Contract Adjustment for Non-conforming Work:
 - 1. Should Architect or District determine that it is not feasible or in District's interest to require non-conforming Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between District 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

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**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 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 are summarized in this section, as adopted by Division of the State Architect:
 - 1. Part 1, Title 24 CCR - 2019 California Administrative Code.
 - 2. Part 2, Title 24 CCR - 2019 California Building Code (CBC); Volumes 1 and 2.
 - a. Based on ICC (IBC) - ICC International Building Code, 2018.

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3. Part 3, Title 24 CCR - 2019 California Electrical Code (CEC, NFPA 70-NEC 2017).
 4. Part 4, Title 24 CCR - 2019 California Mechanical Code (CMC).
 - a. Based on IAPMO (UMC) - Uniform Mechanical Code, 2018.
 5. Part 5, Title 24 CCR - 2019 California Plumbing Code (CPC).
 - a. Based on IAPMO (UPC) - Uniform Plumbing Code, 2018.
 6. Part 6, Title 24 CCR - 2019 California Energy Code.
 7. Part 9, Title 24 CCR - 2019 California Fire Code (CFC).
 - a. Based on ICC (IFC) - International Fire Code; 2018.
 8. Part 10, Title 24 CCR - 2019 California Existing Buildings Code.
 - a. Based on ICC (IEBC) - ICC International Existing Buildings Code, 2018.
 9. Part 11, Title 24 CCR - 2019 California Green Building Standards Code (CalGreen).
 10. Part 12, Title 24 CCR - 2019 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 - 2019 CBC (SFM) Chapter 35.
 2. NFPA 13 - Standard for the Installation of Sprinkler Systems (CA Amended); is current; use 2016, as amended in 2019 CBC Ch.35 Referenced Standards.
 3. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems, as amended in 2019 CBC Ch.35 Referenced Standards.
 4. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances is current; use 2016, as amended in 2019 CBC Ch.35 Referenced Standards.
 5. California Electrical Code:
 - a. NFPA 70 - National Electrical Code.
 - 1) Use 2017 as modified in 2019 CBC Ch.35 Referenced Standards.
 6. NFPA 72 - National Fire Alarm and Signaling Code (CA Amended) is current; use 2016 as amended in 2019 CBC Ch.35 Referenced Standards.

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- 7. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016 is current; use 2016 as indicated in 2019 CBC Ch.35 Referenced Standards.
- 8. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives; 2016 is current; use 2016 as indicated in 2019 CBC Ch.35 Referenced Standards..
- 9. 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 - Americans with Disabilities Act (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

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**SECTION 01 42 19
REFERENCE STANDARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue specified in the individual specification sections, except where a specific date is established by applicable code.
- C. Obtain copies of standards when required by Contract Documents.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CALIFORNIA DEPARTMENT OF GENERAL SERVICES, DIVISION OF THE STATE ARCHITECT

2.01 INTERPRETATION OF REGULATIONS

- A. Document IR A-5 - Acceptance of Products, Materials, and Evaluations Reports .
- B. Current listings are on the DGS website:
<http://www.dgs.ca.gov/dsa/Resources/IRManual.aspx>.

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.01 CFR -- CODE OF FEDERAL REGULATIONS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content.
- C. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- D. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice.

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- E. 29 CFR 1910 - Occupational Safety and Health Standards.
- F. 29 CFR 1910, Subpart D - Walking-Working Surfaces, 1910.21-1910.30.
- G. 29 CFR 1910.23 - Ladders.
- H. 29 CFR 1910.38 - Emergency action plans.
- I. 29 CFR 1910.132-138 - Personal Protective Equipment.
- J. 29 CFR 1910.134 - Respiratory protection.
- K. 29 CFR 1926.62 - Lead.
- L. 29 CFR 1926.1101 - Asbestos.
- M. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- N. 39 CFR 111 - U.S. Postal Service Standard 4C.
- O. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- P. 40 CFR 60 - Standards of Performance for New Stationary Sources.
- Q. 40 CFR 273 - Standards For Universal Waste Management.
- R. 40 CFR 280 - Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks.
- S. 40 CFR 761 - Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, And Use Prohibitions.
- T. 47 CFR 15 - Radio Frequency Devices.
- U. 47 CFR 68 - Connection of Terminal Equipment to the Telephone Network.
- V. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA).
- W. 49 CFR 178 - Specifications for Packaging.
- X. 49 CFR 192.285 - Plastic Pipe: Qualifying Persons to Make Joints.

3.02 CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION

- A. CPSC Pub. No. 325 - Public Playground Safety Handbook.

3.03 EPA -- ENVIRONMENTAL PROTECTION AGENCY

- A. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit.
- B. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
- C. EPA 600-4-790-20 - Methods for Chemical Analysis of Water and Wastes.
- D. EPA 625/1-86/021 - Design Manual: Municipal Wastewater Disinfection.
- E. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air.
- F. EPA 712-C-02-190 - Health Effects Test Guidelines OPPTS 870.1100 Acute Oral Toxicity.

<p>Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55</p>		<p style="text-align: right;">Reference Standards 01 42 19 - 2</p>
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3.04 FDA -- FOOD AND DRUG ADMINISTRATION

- A. FDA Food Code - Chapter 6 - Physical Facilities.

3.05 FEMA -- U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY

- A. FEMA (MAPS) - FEMA Map Service Center.
- B. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment.
- C. FEMA 413 - Installing Seismic Restraints for Electrical Equipment.
- D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe.
- E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage.

3.06 FS -- FEDERAL SPECIFICATIONS AND STANDARDS (GENERAL SERVICES ADMINISTRATION)

- A. FED-STD-595C - Colors Used in Government Procurement (Fan Deck)..
- B. FS L-F-001641 - Floor Covering Translucent or Transparent Vinyl Surface with Backing; 1971, and Amendment 2, 1982.
- C. FS L-S-125 - Screening, Insect, Nonmetallic.
- D. FS RR-P-1352 - Partitions, Toilet, Complete; Revision C, 1989.
- E. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant.
- F. FS RR-W-365 - Wire Fabric (Insect Screening); 1980, Rev. A (Amended 1986).
- G. FS SS-T-312 - Tile, Floor: Asphalt, Rubber, Vinyl, and Vinyl Composition; Revision B, 1974, and Amendment 1, 1979.
- H. FS TT-B-1325 - Beads (Glass Spheres) Retro-Reflective.
- I. FS TT-P-115 - Paint, Traffic (Highway, White and Yellow); Revision F, 1984.
- J. FS TT-P-1952 - Paint, Traffic and Airfield Marking, Waterborne.
- K. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- L. FS W-C-596 - Connector, Electrical, Power, General Specification for.
- M. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification).
- N. STATE STD 01.01 - Certification Standard Forced Entry and Ballistic Resistance of Structural Systems; Physical Security Division, Office of Physical Security Programs, Bureau of Diplomatic Security, United States Department of State.
- O. UFC 4-010-01 - DoD Minimum Antiterrorism Standards for Buildings.
- P. USPS Handbook AS-503 - Standard Design Criteria; United States Postal Service.

3.07 GSA -- U.S. GENERAL SERVICES ADMINISTRATION

- A. GSA PBS-P100 - Facilities Standards for the Public Buildings Service.

3.08 NIJ -- NATIONAL INSTITUTE OF JUSTICE (DEPT. OF JUSTICE)

- A. NIJ 0108.01 - Standard for Ballistic Resistant Protective Materials.

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3.09 PS -- PRODUCT STANDARDS

- A. PS 1 - Structural Plywood.
- B. PS 2 - Performance Standard for Wood Structural Panels.
- C. PS 20 - American Softwood Lumber Standard.

3.10 USDA -- UNITED STATES DEPARTMENT OF AGRICULTURE

- A. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service.

3.11 USGS -- UNITED STATES GEOLOGICAL SURVEY

- A. USGS (FMWQ) - National Field Manual for the Collection of Water-Quality Data; United States Geological Survey.

END OF SECTION

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

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Division of the State Architect (DSA) Procedures for construction oversight and inspections required during the course of construction.
- B. Code-required special inspections.
 - 1. Division of the State Architect (DSA) approved testing laboratory services and inspections required during the course of construction.
- C. Testing services incidental to special inspections.
- D. Submittals.
- E. Manufacturers' field services.
- F. 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 Division of the State Architect.
- 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 District 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.

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- 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 C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- G. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- H. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
- I. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- J. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- K. 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.
- L. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- M. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- N. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.
- O. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- P. 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.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- R. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.
- S. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- T. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck.

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:

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1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit certification that Testing Agency is acceptable to AHJ.
3. Testing and inspections will be performed by an independent testing laboratory selected and employed by the District and approved by the Division of the State Architect (DSA).
 - a. Qualification of a testing agency or laboratory will be under the jurisdiction of the DSA Structural Safety Section (SSS). Procedural and acceptance criteria are set forth in the California Administrative Code (CBC) Chapter 4.
- 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. Distribution List: The Testing Laboratory will make the following distribution of test and inspection reports:
 - 1 District
 - 2 Architect
 - 1 Structural Engineer
 - 1 Contractor
 - 1 District's Inspector
 - 1 Division of the State Architect
- G. Each and every test or inspection report shall bear the File Number and Application Number assigned to this project by the DSA.
- H. DSA Form 291: From the engineering manager of the laboratory of record.
- I. 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.

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2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
 3. Comply with DSA IR 17-12, revised 04/23/20.
- J. 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).
- K. 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.
 - k. Test reports shall be signed by a Civil Engineer licensed in the State of California.
 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.

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- 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.
3. At the completion of the project, Testing Laboratory shall certify in writing and on all required DSA forms, that all work specified or required to be tested and inspected conforms to drawings, specifications and applicable building codes.
4. Verification of Test Reports:
- a. The Testing Laboratory of record shall submit to the Division of the State Architect (DSA) a verified report covering all tests which are required to be made by that agency during the progress of the project.
 - 1) Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time, and at the completion of the project.
 - 2) Specific testing requirements as listed on the Structural Test and Inspections (T&I) Form DSA-103 for this project. These tests may include the following forms:
 - (a) DSA-201: Soils Compaction.
 - (b) DSA-202: Sieve Analysis.
 - (c) DSA-203: Tension/Bend.
 - (d) DSA-204: Compression.
 - (e) DSA-205: Concrete Masonry Unit.
 - (f) DSA-206: Anchor Load.
 - (g) DSA-207: Masonry Core Shear/Compression.
 - (h) DSA-208: High-Strength Bolt.
 - (i) DSA-210: Ultrasonic (NDT).
 - (j) DSA-250: Special Inspection(s).
 - (k) DSA-291: Laboratory Verified Report.
 - (l) DSA-292: Special Inspection(s) Verified Report(s).
 - (m) DSA-293: Geotechnical Verified Report.
 - (n) DSA-403: Energy Compliance Checklist.
 - 3) Other Division of the State Architect (DSA) Certification Documents (Reports) as may be required.
 - b. DSA Form 292 - Special Inspection Verified Report shall be from all special inspectors contracting directly and individually with the school board.
- L. 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.

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- M. 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.
- N. 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. District will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. 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.
- C. 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

- A. District is to employ services of an independent inspection and testing agency to perform observation, testing and sampling associated with special inspections including those not required by the building code. CAC
 1. Project Inspector and testing lab are employed by the District and approved by:
 - a. A/E of Record.
 - b. Structural Engineer (when applicable).
 - c. DSA.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
- B. Testing Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 2. Testing Agency must possess DSA LEA Program acceptance.
- C. 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.

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- D. In general, tests and inspections for structural materials shall include all items enumerated on the Structural Tests and Inspections list for this project as prepared and distributed by the Architect.
- E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

1.09 INSPECTION BY THE DISTRICT

- A. The District 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 District.
 - 2. If the Contractor does not correct such rejected work within a reasonable time, the District may correct such rejected work and charge the expense to the Contractor.
- B. Should it be considered necessary or advisable by the District 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.

1.10 DISTRICT'S INSPECTOR

- A. A Project Inspector (IOR) employed by the District and approved by Architect, Structural Engineer and DSA in accordance with the requirements of the California Building Code will be assigned to the work.
 - 1. Project Inspector duties are specifically defined in CCR Title 24 Part 1, Sec. 4-211(b), 4-219, 4-333(b), 4-336 and 4-342.
- B. The District's Inspector shall at all times have access for the purpose of inspection to all parts of the work and to the shops where the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the District's Inspector.
 - 1. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials.
 - 2. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.
 - 3. Inspector of Record is required to work a normal 40 hour week on this project only. Any overtime required will be at the expense of the Contractor and sub-contractor requiring

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the inspection.

1.11 PAYMENTS

- A. Costs of initial testing and inspection, except as specifically modified herein, or specified otherwise in technical sections, will be paid for by the District, providing such testing and inspection indicates compliance with Contract Documents. Initial tests and inspections are defined as the first tests and inspections as herein specified.
- B. In the event a test or inspection indicates failure of a material or procedure to meet requirements of Contract Documents, costs for retesting and reinspection will be paid by the District and backcharged to the Contractor.
- C. Additional tests and inspections not herein specified but requested by District or Architect, will be paid for by District, unless results of such tests and inspections are found to be not in compliance with Contract Documents, in which case the District will pay all costs for initial testing as well as retesting and reinspection and backcharge the Contractor.
- D. Costs for additional tests or inspections required because of change in materials being provided or change of source or supply will be paid by District and backcharged to the Contractor.
- E. Costs for tests or inspections which are required to correct deficiencies will be paid by the District and backcharged to the Contractor.
- F. Cost of testing which is required solely for the convenience of Contractor in his scheduling and performance of work will be paid by the District and backcharged to the Contractor.
- G. Overtime costs for testing and inspections performed outside the regular work day hours, including weekends and holidays, will be paid for by the District and backcharged to the Contractor. Such costs include overtime costs for the District's Inspector.
- H. Testing Laboratory shall separate and identify on the invoices, the costs covering all testing and inspections which are to be backcharged to the Contractor as specified above.
- I. Testing Laboratory shall furnish to District a cost estimate breakdown covering initial tests and inspections required by Contract Documents. Estimate shall include number of tests, man-hours required for tests, field and plant inspections, travel time, and costs.

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.

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- B. Tests and inspections for the following will be required in accordance with the current CBC, unless otherwise specified.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION (CHAPTER 17A AND 22A)

- 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. Erection Inspection: Testing Laboratory will visually inspect bolted and field welded connections, perform such additional tests and inspections of field work as are required by the Architect and prepare test reports for the Architect's review.
- D. Inspect High Strength Bolt Installation per CBC 1705A.2.1, Table 1705A.2.1.
 - 1. Special inspection for high tension bolting will be provided by the Testing Laboratory. Inspection shall be in accordance with RCSC Specification for Structural Joints Using High Strength Bolts, 2014.
 - 2. Comply with DSA Interpretations:
 - a. IR 17-8: Sampling and Testing of High Strength Bolts, Nuts, and Washers 2019 CBC; Revised 09/24/19.
 - b. IR 17-9: High-Strength Structural Bolting Inspection: 2019 CBC; Revised 09/24/19.
- E. Welding:
 - 1. Testing Laboratory will review welding procedure specifications as prepared by the fabricator.
 - 2. Structural Steel:
 - a. Inspect welding per CBC 1705A.2.5.
 - 1) Comply with DSA IR 17-3: Structural Welding Inspection: 2019 CBC; Revised 09/24/19.
 - b. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M and AWS D1.8/D1.8M; continuous.
 - 3. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 26.6.
 - a. Provide continuous inspection of welding of reinforcing steel per CBC 1705A.3.1; Table 1705A.3, Item 2; 1903A.8.
 - 4. Ultrasonic Testing: All full penetration multi-pass groove welds shall be subject to ultrasonic testing.
 - a. Defective welds shall be repaired and retested with ultrasonic equipment.
 - b. Initially, all multi-pass groove field welds shall be tested at the rate of 100 percent of each individual welder.
 - 1) If rejectable defects occur in less than 5 percent of the welds tested, the frequency of testing may be reduced to 25 percent.
 - 2) If the rate of rejectable defects increases to 5 percent or more, 100 percent testing shall be reestablished until the rate is reduced to less than 5 percent.

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- 3) The percentage of rejects shall be calculated for each welder independently.
- c. When ultrasonic indications arising from the weld root can be interpreted as either a weld defect or the backing strip itself, the backing strip shall be removed at the expense of the Contractor, and if no root defect is visible, the weld shall be retested.
 - 1) If no defect is indicated on this retest, and no significant amount of the base and weld metal have been removed, no further repair or welding is necessary.
 - 2) If a defect is indicated, it shall be repaired at the Contractor's expense.
- 5. Technician to calibrate ultrasonic instrumentation to evaluate the quality of the welds in accordance with AWS D1.1/D1.1M latest Edition.
- 6. 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.
- 7. 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.
- F. 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 District and backcharged to the Contractor.

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

- A. Inspection:
 - 1. Job Site Inspection: CBC 1705A.3, 1705A.3.5 (Conc. Preplacement), 1705A.3.6 (Placing Record), and 1910A.
 - 2. Batch Plant or Weighmaster Inspection: CBC 1705A.3.3.
- B. 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 1901A.6; 1910A.2.
 - a. District's Inspector will inspect all reinforcement for concrete work for size, dimensions, locations and proper placement.
- C. 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.
 - 4. Reinforcing Bar Welding Inspection: CBC 1705A.3.1; Table 1705A.3, Item 2; 1903A.8.
- D. Anchors Cast in Concrete: Verify compliance with ACI 318, 17.8.2; periodic.

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- E. 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.
- F. 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.
- G. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318; periodic.
- H. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with CBC Chapter 19A, ACI 318, Sections 26.4.3, 26.4.4; periodic.
 - 1. Portland Cement Tests: CBC 1705A.3.2, 1910A.1.
 - 2. Concrete Aggregates: CBC 1705A.3.2, 1903A.5.
 - 3. Batch Plant Inspection: CBC 1705A.3.3.
 - 4. Waiver of Continuous Batch Plant Inspection and Tests: CBC 1705A.3.3.1.
 - 5. Admixtures: CBC 1910A.1.
 - 6. Proportions of Concrete: CBC 1904A (Durability) and 1905A (Modifications to ACI 318).
- I. 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.
- J. Concrete Placement: Verify application techniques comply with approved Contract Documents and ACI 318, Chapter 26.5; continuous.
- K. Specified Curing Temperature and Techniques: Verify compliance with ACI 318, Chapter 26.5.3-26.5.5; continuous.
- L. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents, CBC Table 1705A.3, 1905A.1.15, and modified ACI 318, Chapter 26.12.2.1(a).
- M. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Chapter 26.11.1.2(b); continuous.
- N. Welding of Reinforcing Bars: Conduct special inspections and verify Special Inspector's qualifications in accordance with requirements of AWS D1.4/D1.4M.
- O. District Inspector (IOR) will do the following:
 - 1. Inspect placing of reinforcing steel and concrete at Project.
 - 2. Obtain weighmaster's certificate and identify mix before accepting each load.

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3. Keep daily record of concrete placement, identifying each truck load, time of receipt, and location of concrete in structure.
4. Keep record until completion of Project and make available for inspection by DSA Field Engineer or representative.
5. See also subparagraph on Waiver of Continuous Batch Plant Inspection above.
6. During progress of work, take an additional number of test cylinders as directed by Architect. Conform to CBC 1905A.1.15 (modified ACI 318). Test cylinders need not be made for concrete used in exterior flatwork.
 - a. ACI 318 Section 26.12.2.1 shall be replaced and the Contractor shall comply with the following:
 - 1) Samples for strength test of each class of concrete placed each day shall not be taken less than once for each 50 cubic yards (38.3m³) of concrete, or not less than once for each 2,000 square feet (186 m²) of surface area of for slabs or walls.
 - 2) Additional samples for seven day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
7. One set of cylinders shall consist of 4 samples all taken from same batch, one to be tested at age of 7 days and two at 28 days.
8. Make and store cylinders according to ASTM C31/C31M.
9. Deliver cylinders to laboratory or store cylinders in a suitable protected environment for pick up by laboratory personnel.
10. Make slump test of wet concrete according to test for slump of portland cement concrete, ASTM C143/C143M, at least at the same frequency that the cylinders are taken.

3.04 SPECIAL INSPECTIONS FOR SITE-BUILT WOOD CONSTRUCTION

- A. Conform to CBC 1705A.5.3 Wood Structural Elements and Assemblies.
- B. Conform to CBC 1705A.5.4 for Structural Glue Laminated Timber.

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 17A, 18A, and 33):
 1. Earth Compaction: CBC 1705A.6; Table 1705A.6, continuous; 1804A.6.

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2. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill: CBC 1705A.6.1; Table 1705A.6, periodic; 1804A.6.
- D. The Geotechnical Engineer of record or a Geotechnical Engineer selected by the District 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 SEISMIC RESISTANCE

- A. Seismic Force-Resisting Systems: Comply with the quality assurance plan requirements of AISC 341.
- B. Inspection: Comply with CBC 1705A.12.
- C. Testing: Comply with CBC 1705A.13.
- D. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.
- E. Structural Wood:
 1. Field gluing; continuous.
 2. Nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system; periodic.

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- F. 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.
- G. 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 1705A.12.5 and 1705A.13.2.
- H. 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.
- I. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.
- J. Structural Testing for Seismic Resistance:
 - 1. Concrete reinforcement: Comply with ACI 318, Section 20.2.2.5 and 21.1.52.
 - 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.
- K. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

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3.08 SPECIAL INSPECTIONS FOR WIND RESISTANCE

- A. Structural Wood:
 - 1. Field gluing of components in the main wind force-resisting system; continuous.
 - 2. Nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic.
- B. 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
- C. 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.
- D. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.09 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.

3.10 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:

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- 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.

3.11 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, SEOR, IOR, DSA, District 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.

3.12 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.

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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 District'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 DSA forms, that all work specified or required to be tested and inspected conforms to drawings, specifications and applicable building codes.
1. See DSA Procedure PR 13-01.
- G. Duties of the Laboratory of Record related to the use of form DSA 152 are as follows:
1. Meet with the Project Inspector, design professionals, and contractor as needed to mutually communicate and understand the testing and inspection program and the methods of communication appropriate for the project.
 2. Obtain a copy of the DSA approved construction documents from the design professional in general responsible charge prior to the commencement of construction
 3. Obtain a copy of the DSA approved Statement of Structural Tests and Special Inspections (form DSA 103) from the design professional in general responsible charge prior to the commencement of construction.
 4. Report all project related activities to the Project Inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and Special Inspectors to ensure the testing and special inspection program is satisfactorily completed
 5. Provide material testing as identified in the DSA approved construction documents.
 6. Submit test reports to the Project Inspector on the day the tests were performed for any tests performed on-site
 7. Submit material test reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the material tests were performed. Test reports are to be submitted to DSA, the Architect, structural engineer, Project Inspector and school

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district.

- a. As a convenience, and if agreed upon by involved parties, the test reports may be submitted electronically as identified in Section 4 of this procedure.
- 8. Immediately submit reports of material tests not conforming to the requirements of the DSA approved construction documents. These reports shall be submitted to the DSA, Architect, structural engineer, Project Inspector and school district.
- 9. The Engineering Manager shall submit an interim Laboratory of Record Verified Report (form DSA 291) and the Geotechnical Engineer shall submit an interim Geotechnical Verified Report (form DSA 293) to DSA, the project inspector, school district and the Design Professional in General Responsible Charge.
 - a. The reports are required to be submitted upon any of the following events occurring:
 - 1) Within 14 days of the completion of the material testing/special inspection program.
 - 2) Work on the project is suspended for a period of more than one month.
 - 3) The services of the laboratory of record are terminated for any reason prior to completion of the project.
 - 4) The DSA requests a Verified Report. (See interim verified reports below. This is a "DSA request.")
- 10. The Engineering Manager shall submit an interim verified report (form DSA 291) and the Geotechnical Engineer shall submit form DSA 293 to DSA and a copy to the project inspector for each of the applicable sections of the form DSA 152, prior to the project inspector signing off that section of the project inspection card, if that section required material testing. The sections are:
 - a. Initial Site Work
 - b. Foundation Prep
 - c. Vertical Framing
 - d. Horizontal Framing
 - e. Appurtenances
 - f. Finish Site Work
 - g. Other Work
 - h. Final
- H. Duties of Special Inspectors, employed by the Laboratory of Record, related to the use of form DSA 152 are as follows:
 - 1. Meet with the Project Inspector, design professionals, and contractor as needed to mutually communicate and understand the testing and inspection program and the methods of communication appropriate for the project.
 - 2. Report all project related activities to the Project Inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and Special Inspectors to ensure the testing and special inspection program is satisfactorily completed.

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3. Perform work under the supervision of the Engineering Manager for the Laboratory of Record
4. Perform inspections in conformance with the DSA approved construction documents, applicable codes and code reference standards
5. Prepare detailed daily inspection reports outlining the work inspected and provide the Project Inspector a copy of the reports on the same day the inspections were performed.
6. Prepare detailed daily inspection reports outlining the work inspected and provide the Project Inspector a copy of the reports on the same day the inspections were performed.
7. Immediately submit reports of materials or work not conforming to the requirements of the DSA approved construction documents. These reports shall be submitted to the DSA, Architect, structural engineer, Project Inspector and school district.
8. Submit daily special inspection reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the special inspections were performed. The reports are to be submitted to the Architect, structural engineer, Project Inspector and school district.
9. Submit Verified Report forms DSA 292 to the DSA, Project Inspector, district and design professional in responsible charge.
10. The reports are required to be submitted upon any of the following events occurring:
 11. Within 14 days of the completion of the special inspection work.
 12. Work on the project is suspended for a period of more than one month.
 13. The services of the special inspector are terminated for any reason prior to completion of the project.
 14. The DSA requests a Verified Report. (See interim verified reports below. This is a "DSA request")
 15. Submit an interim Verified Report (form DSA 292) to the DSA and a copy to the Project Inspector for each of the applicable sections of the form DSA 152, prior to the Project Inspector signing off that section of the project inspection card, if that section required special inspections. The sections are:
 - a. Initial Site Work
 - b. Foundation
 - c. Vertical Framing
 - d. Horizontal Framing
 - e. Appurtenances
 - f. Non-Building Site Structures
 - g. Finish Site Work
 - h. Other Work
 - i. Final
16. The Verified Reports shall be sent electronically to the DSA.

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- I. Duties of Special Inspectors, not employed by the Laboratory of Record, related to the use of form DSA 152 are as follows:
 1. Meet with the project inspector, Laboratory of Record, the design professionals, and the contractors as needed to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the project.
 2. Report all project related activities to the project inspector. The project inspector is responsible for monitoring the work of the Laboratory of Record and special inspectors to ensure the testing and special inspection program is satisfactorily completed.
 3. Perform work under the direction of the design professional in general responsible charge, as defined in Section 4-335(f)1B of the California Administrative Code (Title 24, Part 1).
 4. Perform inspections in conformance with the DSA approved construction documents, applicable codes and code reference standards.
 5. Prepare detailed daily inspection reports outlining the work inspected and provide the project inspector a copy of the reports on the same day the inspections were performed.
 6. Immediately submit reports of materials or work not conforming to the requirements of the DSA approved construction documents. These reports shall be submitted to DSA, the Architect, structural engineer, project inspector and the school district.
 7. Submit daily special inspection reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the special inspections were performed. The reports are to be submitted to DSA, the Architect, structural engineer, project inspector and the school district.
 8. Submit Special Inspection Verified Report forms DSA 292 to DSA, the project inspector, the school district and the Design Professional in General Responsible Charge.
 - a. The reports are required to be submitted upon any of the following events occurring:
 - 1) Within 14 days of the completion of the special inspection work.
 - 2) Work on the project is suspended for a period of more than one month.
 - 3) The services of the special inspector are terminated for any reason prior to completion of the project.
 - 4) DSA requests a verified report. (See interim verified reports below. This is a "DSA request.")
 9. Submit an interim Special Inspection Verified Report (form DSA 292) to DSA and a copy to the project inspector for each of the applicable sections of the form DSA 152, prior to the project inspector signing off that section of the project inspection card, if that section required special inspections.
 - a. The sections are:
 - 1) Initial Site Work
 - 2) Foundation Prep
 - 3) Vertical Framing

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- 4) Horizontal Framing
- 5) Appurtenances
- 6) Finish Site Work
- 7) Other Work
- 8) Final

3.13 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. DSA Requirements:

- 1. Each Multi-Prime Contractor or Subcontractor shall comply with DSA Construction Oversight Procedure PR 13-01. California Code of Regulations (CCR), Title 24, Part 1, CCR, Chapter 4, Article 1 (Sections 4-211 through 4-220) and Group1, Articles 5 and 6 (Sections 4-331 through 4-344) which provide regulations governing the construction process for projects under the jurisdiction of the Division of the State Architect (DSA).
 - a. Assist the Project Inspector (IOR) and complete and fill out the following forms during the course of construction.
 - 1) Form-102-IC: Construction Start Notice/ Inspection Card Request: Verify Project Inspector has an active form issued by DSA.
 - 2) Form-151: Project Inspector Notifications: Contractor to notify IOR and assist.
 - 3) Form-152: Project Inspection Card: See below.
 - 4) Form-154: Notice of Deviations/ Resolution of Deviations: Contractor to verify all deviations are reviewed, corrected, and accepted by the design professional, and filed with DSA through the Project Inspector (IOR).
 - (a) When the Project Inspector identifies deviations from the DSA approved construction documents the inspector must verbally notify the contractor. If the deviations are not corrected within a reasonable time frame, the inspector is required to promptly issue a written notice of deviation to the contractor, with a copy sent to the design professional in general responsible charge and the DSA.
 - (b) When the noticed deviations are corrected, the inspector is required to promptly issue a written notice of resolution to the contractor, with a copy sent to the design professional in general responsible charge and the DSA.
 - (c) Deviations include both construction deviations and material deficiencies.
 - (d) The written notice of deviations shall be made using form DSA 154.
 - (e) The notice of resolution of deviations shall be made using the original form DSA 154 that reported the deviations.
 - 5) Form-156: Commencement/Completion of Work Notification
 - 6) Form-6.C: Verified Report – Contractor: From each contractor having a contract with the school board.
- 2. Duties of Contractor related to the use of form DSA 152 are as follows:
 - a. The Contractor shall carefully study the DSA approved documents and shall plan a schedule of operations well ahead of time.

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- b. If at any time it is discovered that work is being done which is not in accordance with the DSA approved construction documents, the Contractor shall correct the work immediately.
- c. Verify that forms DSA 152 are issued for the project prior to the commencement of construction.
- d. Meet with the design team, the Laboratory of Record and the Project Inspector to mutually communicate and understand the testing and inspection program and the methods of communication appropriate for the project.
- e. Notify the Project Inspector, in writing, of the commencement of construction of each and every aspect of the work at least 48 hours in advance by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.
- f. Notify the Project Inspector of the completion of construction of each and every aspect of the work by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.
- g. Consider the relationship of the signed off blocks and sections of the form DSA 152 and the commencement of subsequent work. Until the Project Inspector has signed off applicable blocks and sections of the form DSA 152, the Contractor may be prohibited from proceeding with subsequent construction activities that cover up the unapproved work. Any subsequent construction activities, that cover up the unapproved work, will be subject to a "Stop Work Order" from the DSA or the district and are subject to removal and remediation if found to be in non-compliance with the DSA approved construction documents.
- h. Submit the final verified report. All prime contractors are required to submit final Contractor Verified Reports (form DSA 6-C) to DSA and the project inspector.
 - 1) The reports are required to be submitted upon any of the following events occurring:
 - (a) The project is substantially complete. DSA considers the project to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the owner can occupy or utilize the project.
 - (b) Work on the project is suspended for a period of more than one month.
 - (c) The services of the contractor are terminated for any reason prior to the completion of the project.
 - (d) DSA requests a verified report.

B. Contractor Responsibilities, General:

- 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
- 2. Availability of Samples
 - a. Contractor shall make materials required for testing available to Laboratory and assist in acquiring these materials as directed by the District's Inspector. The samples shall be taken under the immediate direction and supervision of the Testing Laboratory or District's Inspector.

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- b. If work which is required to be tested or inspected is covered up without prior notice or approval, such work may be uncovered at the discretion of Architect at no additional cost to the District. Refer to paragraph "Payments" herein.
 - c. Unless otherwise specified, Contractor shall notify Testing Laboratory a minimum of 10 working days in advance of all required tests, and a minimum of 2 working days in advance of all required inspections. All extra expenses resulting from a failure to notify the Laboratory will be paid by the District and backcharged to the Contractor.
 - d. Contractor shall give sufficient advance notice to Testing Laboratory in the event of cancellation or time extension of a scheduled test or inspection. Charges due to insufficient advance, notice of cancellations, or time extension will be paid for by the District and backcharged to the Contractor.
3. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 4. 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.
 5. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 6. Arrange with District's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 7. The Contractor shall notify the District'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 District may arrange for the testing of such material at the source of supply.
 8. 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.
 9. The District 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.
- C. 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:

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- 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.
- D. 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 District prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- E. 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 District prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- F. Unless otherwise directed, materials not conforming to the requirements of Contract Documents shall be promptly removed from the Project site.

3.14 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 District.
- 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

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**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.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.04 TEMPORARY UTILITIES - SEE SECTION 01 51 00

- A. District will provide the following:
 - 1. Electrical power and metering, consisting of connection to existing facilities.
 - 2. Water supply, consisting of connection to existing facilities.
- B. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- 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. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.

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- 4. Email: Account/address reserved for project use.

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 Construction Manager for approval.
 - a. Place on-site portable toilets away from building air intakes and entryway.
- B. Maintain daily in clean and sanitary condition.
- C. 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.
- D. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- E. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
- F. Construction: Contractor's option.

1.07 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.

1.08 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from District-occupied areas, to prevent penetration of dust and moisture into District-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 District-occupied areas.

1.09 SECURITY

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

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1.10 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 Construction Manager proposed location of any break areas and eating areas for approval.

1.11 SMOKING AND TOBACCO

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

1.12 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 District.
- 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.

1.13 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.

1.14 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 District permission except those required by law.

1.15 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 District.

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- D. Provide separate private office similarly equipped and furnished, for use of Architect and District.
- E. Locate offices a minimum distance of 30 feet from existing and new structures.

1.16 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

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**SECTION 01 51 00
TEMPORARY UTILITIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Power Service Characteristics: 480 volt, 200 ampere, three phase, four wire.
- D. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
- E. Provide main service disconnect and over-current protection at convenient location and meter.
- F. Permanent convenience receptacles may be utilized during construction.
- G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.
- H. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- I. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.
- J. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- K. Maintain lighting and provide routine repairs.
- L. Permanent building lighting may be utilized during construction.

1.05 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.

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- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Existing facilities shall not be used.
- E. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.06 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Existing facilities shall not be used.
- E. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used.
- B. Cost of Water Used: By Contractor.
- C. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- D. Connect to existing water source.
 - 1. Exercise measures to conserve water.
- E. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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**SECTION 01 52 13
FIELD OFFICES AND SHEDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary field offices for use of Architect.
- B. Temporary field offices for use of Construction Manager.
- C. Temporary field offices for use of Project Inspector.
- D. Temporary field offices for use of Contractor.
- E. Maintenance and removal.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: use of premises and responsibility for providing field offices.
- B. Section 01 50 00 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.
- C. Section 01 55 00: Parking and access to field offices.

1.03 USE OF EXISTING FACILITIES

- A. Existing facilities shall not be used for field offices.

1.04 USE OF PERMANENT FACILITIES

- A. Permanent facilities shall not be used for field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

- A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
- B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.
- C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.
- D. Exterior Materials: Weather resistant, finished in one color.
- E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.

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- F. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.
- G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

- A. Size: For Contractor's needs and to provide space for project meetings.
- B. Telephone: As specified in Section 01 50 00.
- C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.
- D. Other Furnishings: Contractor's option.
- E. Equipment: Six adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer .

2.05 CONSTRUCTION MANAGER, DISTRICT, OWNER, PROJECT INSPECTOR, ARCHITECT, AND ENGINEER OFFICE

- A. Separate space for sole use of District and Architect, with separate entrance door with new lock and two keys.
- B. Windows: At least three, with minimum total area equivalent to 10 percent of floor area, with an operable sash and insect screen. Locate to provide views of construction area.
- C. Electrical Distribution Panel: Four circuits minimum, 110 volt, 60 hz service.
- D. Minimum for each 10 foot length, provide 110 volt duplex convenience outlets, on each wall of the office open space.
- E. Provide four 110 volt duplex convenience outlets in each office.
- F. Telephone: As specified in Section 01 50 00.
- G. Sanitary Facilities: As specified in Section 01 50 00.
- H. Drinking Fountain: Convenient access by workers.

PART 3 EXECUTION

3.01 PREPARATION

- A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.
- B. Parking: Two hard surfaced parking spaces for use by District and Architect, connected to office by hard surfaced walk.

3.03 MAINTENANCE AND CLEANING

- A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

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B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

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**SECTION 01 55 00
VEHICULAR ACCESS AND PARKING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Permanent pavements and parking facilities.
- E. Construction parking controls.
- F. Flag persons.
- G. Flares and lights.
- H. Haul routes.
- I. Traffic signs and signals.
- J. Maintenance.
- K. Removal, repair.
- L. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: For access to site, work sequence, and occupancy.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Construction: Contractor's option.
- B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

2.02 SIGNS, SIGNALS, AND DEVICES

- A. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- B. Flag Person Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

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- B. Limit the number of haul trucks on site and establish a haul route. Install a gravel or base road on site for loading trucks. Haul route shall be reviewed and approved by DSA.
- C. Provide a boundary/zone where equipment shall not enter because of proximity to active adjacent operation, and if necessary, equipment shall operate on alternative fuel to reduce diesel particulate matter.
- D. Establish construction site and access road speed limits and enforce them during the construction period.
- E. Restrict the hours of material transport to the periods and days permitted by both this contract and local noise or other applicable ordinance.
- F. Schedule haul trucks and material delivery trucks to prevent traffic congestion and impede the normal operation of the Facility. Set up truck queuing area away from public entrances.

3.02 ACCESS ROADS

- A. Use of existing on-site streets and driveways for construction traffic is permitted.
- B. Tracked vehicles not allowed on paved areas.
- C. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.
- D. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
- E. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

- A. Use of designated areas of existing parking facilities by construction personnel is permitted.
 - 1. DSA will meet with Contractor(s) to determine parking requirements.
- B. DSA will notify security of parking area to be used by construction personnel if at variance with this procedure.
- C. Use of designated areas of new parking facilities by construction personnel is permitted.
- D. Contractor(s) and related personnel shall park in authorized areas only.
- E. Do not allow heavy vehicles or construction equipment in parking areas.
- F. Arrange for temporary parking areas to accommodate use of construction personnel.
- G. When site space is not adequate, provide additional off-site parking.

3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

- A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.
- B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.05 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and District's operations.

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- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.06 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.07 FLARES AND LIGHTS

- A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.08 HAUL ROUTES

- A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.09 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Relocate as work progresses, to maintain effective traffic control.

3.10 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.11 REMOVAL, REPAIR

- A. Remove underground work and compacted materials to a depth of 2 feet; fill and grade site as specified.
- B. Repair existing facilities damaged by use, to original condition.
- C. Remove equipment and devices when no longer required.
- D. Repair damage caused by installation.
- E. Remove post settings to a depth of 2 feet.

3.12 MUD FROM SITE VEHICLES

- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

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**SECTION 01 56 39
TEMPORARY TREE AND PLANT PROTECTION**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Tree protection of existing trees and plants
- B. Tree pruning of existing trees

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Temporary Facilities and Controls
- B. Division 31 - Earthwork: Site Clearing.
- C. Division 32 - Exterior Improvements: Landscape Work.

1.03 REFERENCE STANDARDS

- A. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning).
- B. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.

1.04 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4 inch size; and 12 inches above the ground for trees larger than 4 inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of the following:
 - 1. Organic Mulch: 1 quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 - 2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
 - 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.

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2. Location on site plan. Include unique identifier for each.
 3. Reason for pruning.
 4. Description of pruning to be performed.
 5. Description of maintenance following pruning.
- D. Qualification Data: For qualified arborist and tree service firm.
- E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
1. Use sufficiently detailed photographs or videotape.
 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.06 QUALITY ASSURANCE

- A. Arborist Qualifications:
1. Certified Arborist as certified by ISA.
 2. Licensed Arborist in jurisdiction where Project is located.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
 - b. Enforcing requirements for protection zones.
 - c. Arborist's responsibilities.
 - d. Contractor responsibilities
 - e. Field quality control.

1.07 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.

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3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or trenching or digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
8. Do not direct vehicle or equipment exhaust toward protection zones.
9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch. Insert dimension in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
 2. Refer to Division 32 - Exterior Improvements, "Landscape Work" for material requirements.
- B. Topsoil: Stockpiled topsoil from location shown on Drawings.
- C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 1. Type: Wood and bark chips.
 2. Size Range: 1/2 inch minimum, 1 inch maximum.
 3. Color: Natural.
- D. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Architect.
 1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2 inch opening, 0.148 inch diameter wire chain-link fabric; with pipe posts, minimum 2-3/8 inch OD line posts, and 2-7/8 inch OD corner and pull posts; with 1-5/8 inch OD top rails and 0.177 inch diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: 6 feet.
 - b. Polymer-Coating Color: Black.
 2. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches36 inches.

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- E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
 1. Size: as required
 2. Text: "TREE PROTECTION ZONE - KEEP OUT. No unauthorized entry. No storage of vehicles, materials, or debris. No dumping of chemicals, slurry, paint, oil, etc. "
 3. Lettering: 3 inch high minimum, black characters on white background.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag - Tie a 1 inch blue-vinyl tape around each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
 1. Apply 3 inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.03 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 3. Access Gates: Install as required; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks

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engage accurately and securely without forcing or binding.

- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
- E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.04 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only roots smaller than 2" in diameter that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.05 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Do not paint cut root ends. Coat cut ends of roots more than 1-1/2 inches in diameter with emulsified asphalt or other coating formulated for use on damaged plant tissues as approved by the arborist.

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3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Section 31 22 00 - Grading.
- B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.06 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
 2. Pruning Standards: Prune trees according to ANSI A300 Part 1 and the following:
 - a. Type of Pruning: Cleaning Thinning Raising Reduction.
 3. Cut branches with sharp pruning instruments; do not break or chop.
 4. Do not apply pruning paint to wounds.
- B. Chip removed branches and dispose of off-site.

3.07 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 4 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.08 FIELD QUALITY CONTROL

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

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3.09 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed root cutting and tree and shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 4. Perform repairs within 24 hours.
 - 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
 - 2. Provide one new tree(s) of 6 inch caliper size for each tree being replaced that measure more than 4 inches in caliper size.
 - a. Species: Species selected by Architect.
 - 3. Plant and maintain new trees as specified in Division 32 - Exterior Improvements, Section "Landscape Work"
- C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction.
 - 1. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk.
 - 2. Drill 2 inch diameter holes a minimum of 12 inches deep at 24 inches O.C.
 - 3. Backfill holes with an equal mix of native soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

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**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 District 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 District.

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.

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- 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. District will obtain permits and pay for securities required by authority having jurisdiction.
 - 2. District will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- F. Provide to District 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.

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- 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 District.
- 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 District.
- 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 District; 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 District; 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.

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- 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 District.
- 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 Substantial Completion.

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.

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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 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.
 - b. North American Green: www.nagreen.com.
 - c. Propex Geosynthetics: 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.

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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:

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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.

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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:

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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

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.
- B. Building flush-out after construction and before occupancy.
- C. Testing indoor air quality before commencement of construction; existing building areas only.
- D. Testing indoor air quality after completion of construction.
- E. 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 Construction Manager.
 - 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. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): HVAC filters.
- F. 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.
- G. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Cleaning air ducts, equipment, and terminal units.

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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.
- 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.

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- 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. Include preliminary tests of instruments and apparatus and of test spaces.
 - 2. Calculation of ventilation effectiveness, 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.

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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.

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- 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 District'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.

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- 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. Air Contaminant Concentration Limits:
 - 1. Comply with CalGreen Building Standards Section 5.504.4.5, Table 504.4.4.5 "Formaldehyde Limits".
 - 2. Formaldehyde: Not more than 16.3 parts per billion.
 - 3. PM10 Particulates: Not more than 20 micrograms per cubic meter.
 - 4. Comply with CalGreen Building Standards Section 5.504, Table 504.4.3 "VOC Content Limits for Architectural Coatings".
 - 5. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit" and Table 504.4.2 "Sealant VOC Limit".
 - 6. Total Volatile Organic Compounds (TVOCs): Not more than 200 micrograms per cubic meter.
 - 7. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
 - 8. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

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9. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
 10. 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-6.
 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 District, 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 District.

END OF SECTION

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**SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign.
- B. Project informational signs.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Responsibility to provide signs.
- B. Section 01 50 00 - Temporary Facilities and Controls: Temporary wood barriers and enclosures.
- C. Section 06 10 53 - Miscellaneous Rough Carpentry: General requirements for structural and non-structural rough carpentry Work.

1.03 REFERENCE STANDARDS

- A. FHWA (SHS) - Standard Highway Signs and Markings.

1.04 QUALITY ASSURANCE

- A. Design sign and structure to withstand 80 miles/hr wind velocity.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New, wood, structurally adequate to support sign panel and suitable for specified finish.
- B. Sign Surfaces: Exterior grade plywood with medium or high density phenolic sheet overlay, minimum 3/4 inch thick, standard large sizes to minimize joints. Provide sheet thickness as required to span across framing members and provide even, smooth surface without waves or buckles.
- C. Rough Hardware: Galvanized steel, as specified in Section 05 50 00 - Metal Fabrications..
- D. Sign Face Paint and Primers: Exterior quality, primer, two gloss enamel finish coats; sign background of color as selected. Provide paint type as customarily used for sign painting, adequate to resist weathering and fading for the scheduled construction period.

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- E. Sign Structure Paint and Primers: Exterior quality, primer, one gloss enamel finish coats; color as selected. Provide paint type as customarily used for sign painting, adequate to resist weathering and fading for the scheduled construction period.
- F. Lettering: Exterior quality paint, colors as selected.

2.02 PROJECT IDENTIFICATION SIGN

- A. One painted sign, 48 sq ft area, bottom 6 feet above ground.
- B. Content:
 - 1. Project number, title, logo and name of District as indicated on Contract Documents.
 - 2. Include organizational logos of parties identified on sign.
 - 3. Names and titles of authorities.
 - 4. Names and titles of Architect and Consultants.
 - 5. Name of Prime Contractor and major Subcontractors.
- C. Graphic Design, Colors, Style of Lettering: Designated by Architect.
 - 1. Sign Painting: Sign panels shall be shop painted and field installed.
 - a. Sign painting shall be performed by professional sign painters. Silk screen method is recommended in order to accurately depict graphics.
 - b. Paint back and edges of sign panels for complete weather resistance and finished appearance.
- D. Project Address Signs: Provide Project name and street address signs, minimum of 4 feet wide, to identify Project to facilitate deliveries.
 - 1. Graphic design and colors shall match Project Identification Sign.
 - 2. Text shall be as directed.
- E. Lettering: Standard Alphabet Series C, as specified in FHWA (SHS).

2.03 PROJECT INFORMATIONAL SIGNS

- A. Restrictions: Signs other than Project Identification Sign specified above and Project Informational Signs specified below shall not be displayed without approval of Architect.
- B. Project Informational Signs: Informational signs, necessary for conduct of construction activities or required by governmental authorities having jurisdiction may be displayed when in conformance to sign construction and graphic requirements specified in this Section.
 - 1. Architect may review such signs. If so, review will be for sign construction, and graphic designs only.
 - 2. Adequacy of signage for safety and conformance to requirements of authorities having jurisdiction and trade practices shall be solely Contractor's responsibility.
- C. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot distance.
 - 1. Colors shall be as required by authorities having jurisdiction and, if not otherwise required, of colors consistent with Project graphics.

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- 2. Informational signage shall be produced by professional sign painters and be of size and lettering style consistent with use.
- D. Provide at each field office, storage shed , and directional signs to direct traffic into and within site. Relocate as Work progress requires.
- E. Provide municipal traffic agency directional traffic signs to and within site.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at location of high public visibility adjacent to main entrance to site.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint exposed surfaces and edges of sign, supports, and framing for a finished appearance.
- F. Project Identification Sign Installation
 - 1. Construction: Construct sign support structure and install panels in durable manner, to resist high winds.
 - 2. Installation: Erect Sign on site at a lighted location of high public visibility, adjacent to the main entrance to the site, as approved by Architect.
 - a. Install sign at height for optimum visibility, on ground-mounted poles or attached to portable structure on skids.
 - b. Portable structure shall resist overturning force of wind.
 - 3. Street Address Signs: Locate and install signs at each access point from public streets.
- G. Project Informational Signs Installation:
 - 1. Construction: Construct sign support structure and install panels in durable manner, to resist high winds.
 - 2. Project Informational Signs Installation:
 - a. Locate signs as necessary for construction activities and as required by authorities having jurisdiction.
 - b. Install informational signs for optimum visibility, on ground-mounted posts or temporarily attached to surfaces of structures.
 - c. Attachment methods shall leave no permanent disfiguration or discoloration on completed Work.

3.02 MAINTENANCE

- A. Maintain signs and supports neat clean condition. Repair all deterioration, weathering and damage to structure framing, and signage.
- B. Sign Relocation: Relocate signs as required by progress of the Work.

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3.03 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area prior to Substantial Completion review.

END OF SECTION

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**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. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for District-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Identification of District-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. Technical Specifications Sections.

1.03 REFERENCE STANDARDS

- A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content.
- B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.
- C. 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.

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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.
- B. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
 1. 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.
- C. Recycled Content: Determine percentage of post-consumer and pre-consumer (post-industrial) content separately, using the guidelines contained in 16 CFR 260.13.
 1. Previously used, reused, refurbished, and salvaged products are not considered recycled.
 2. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
 3. 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.
 4. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
 5. Acceptable Evidence:
 - a. For percentage of recycled content, information from manufacturer.
 - b. For cost, Contractor's cost data.
- D. Reused Products: Materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
 1. Wood fabricated from timber abandoned in transit after harvesting is considered reused, not recycled.
 2. Acceptable Evidence: Information about the origin or source, from Contractor or supplier.

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- E. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
 - 1. American Forest Foundation, The American Tree Farm System; refer to <http://www.treefarmssystem.org>.
 - 2. 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>.
 - 3. Sustainable Forestry Board, under The Sustainable Forestry Initiative® of the American Forest & Paper Association; refer to <http://www.afandpa.org>.
 - 4. 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. DSA (Division of the State Architect) 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.

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- 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 District 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 Division of the State Architect.
 - 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.

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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 regarding construction interfacing and coordination.

2.03 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.

2.04 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

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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.

2.05 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:

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- 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 District 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:

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- 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 District or for work under separate contract by District.
 - 3. Use of product(s) under the "or equal" provision shall not result in any costs to the District, 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 District, 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

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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.

2.06 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 District-supplied products.
- B. District's Responsibilities:
 1. Arrange for and deliver District 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 District reviewed shop drawings, product data, and samples.
 2. Receive and unload products at site; inspect for completeness or damage jointly with District.
 3. Handle, store, install and finish products.
 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. See also Section 01 66 00 - Product Delivery Storage and Handling.
- B. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- C. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- D. 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.

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- 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.
- E. Transport and handle products in accordance with manufacturer's instructions.
- F. Transport products by methods to avoid product damage.
- G. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- H. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- I. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- J. 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.
 - 1. Execute a formal supplemental agreement between District and Contractor allowing off-site storage, for each occurrence.
- K. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other

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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 along with Section 01 50 00 - Temporary Facilities and Controls and Section 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.

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- C. Comply with additional requirements specified in Section 01 50 00 - Temporary Construction Facilities and Controls.

END OF SECTION

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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. Free-standing furniture.
 - 8. 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.

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- 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. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association.
- D. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.
- E. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board.
- F. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- G. CHPS (HPPD) - High Performance Products Database.
- H. CRI (GL) - Green Label Testing Program - Certified Products.
- I. CRI (GLP) - Green Label Plus Testing Program - Certified Products.
- J. GreenSeal GS-36 - Standard for Adhesives for Commercial Use.
- K. SCAQMD 1113 - Architectural Coatings.
- L. SCAQMD 1168 - Adhesive and Sealant Applications.
- M. SCS (CPD) - SCS Certified Products.
- N. 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.

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- 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.

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.

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- 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current SCS "No Added Formaldehyde (NAF)" certification; 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. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.
 - 1. Evidence of Compliance:
 - a. Test report showing compliance and stating exposure scenario used.
- E. 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. Furnishings: Comply with Furnishings Emissions Standard and Test Method.
 - 3. 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.

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- 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. District 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 District.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

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

1.01 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.

2.01 CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)

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

END OF SECTION

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**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 District 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 Division of the State Architect 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

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- 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. 35 - California Fire Code - Chapter 35 - Welding and Other Hot Work.
- C. 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 District 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 District or separate Contractor.
 - f. Effect on existing construction of District and, if applicable, work for Project being provided by District under separate contract.
 - g. Written permission of affected separate Contractor.

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- h. Date and time work will be executed.
- 7. Include written evidence that those performing work under separate contract for District 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.

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- 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 District occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of District'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.

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- 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.

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- E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, District, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Notify the District 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 District 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.

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- 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. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access

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- or provide access panel.
- 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
- 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
- 4. Verify that abandoned services serve only abandoned facilities.
- 5. 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; patch holes left by removal using materials specified for new construction.
- F. 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.
- G. 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.
- H. 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.
- I. 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.
- J. Clean existing systems and equipment.

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- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. 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.

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- 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.

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- 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 District 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 District, 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. District's partial occupancy requirements.
 - g. Installation of District's furniture, fixtures, and equipment.
 - h. Responsibility for removing temporary facilities and controls.

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

3.12 COMMISSIONINGPROJECT

- 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 District. 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 District prior to final completion before District occupancy.
- C. Final Inspection Review Cleaning, General: Execute a thorough cleaning prior to Completion review by Architect and District. 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 Construction Manager for suitability and compatibility. Use no cleaning agents and materials without approval

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as noted above.

2. Cleaning Procedures: All cleaning processes, agents and materials shall be subject to Architect, District and/or Construction Manager review and approval. Processes and degree of cleanliness shall be as directed by Architect, District and/or Construction Manager.
- 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 District.
- B. Accompany District, Architect, and Construction Manager 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 District; Architect and Architect's and District'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 District.
 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.

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3. Locks and Keys: Change temporary lock cylinders over to permanent keying and transmit keys to the District, unless otherwise directed or specified.
 4. Tests and Instructions: Complete start-up testing of systems, and instruction of the District'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. District 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 District.
 - 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 District'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 DSA, the Architect and the Architect's and District'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 District, 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.

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- a. Contractor shall provide three working days notice to Architect for requested date of Final Inspection meeting.
 - b. The Construction Manager, the Architect with Architect's / District's consultants, as authorized by the District, 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 District, submission of operation and maintenance data (manuals), provision of specified extra materials to the District, and submission of other Contract closeout documents and materials as required and if not already submitted.
 - d. The Construction Manager, 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 Construction Manager, the Architect and the Architect's and District's consultants are required to review completion and correction of the Work, the costs of additional visits shall be reimbursed to the District 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 District-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 District 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 District.
 - 2. All extra materials and maintenance stock have been transferred and received by District.
 - 3. All warranty documents and operation and maintenance data have been received and accepted by District.
 - 4. All liens have been released or bonded by Contractor.
 - 5. Contractor's surety has consented to Final Payment.

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6. All documentation required by DSA 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 District.

END OF SECTION

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**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, and pipeline 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.

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- 12. Instructions received from Architect or District, 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:

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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 District'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 District of all discrepancies of which Contractor is aware.
- E. Cooperate as required with Architect and District 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 District'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.

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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 District 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.

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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. District 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 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

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superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.07 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 District 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 District. 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.

3.08 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

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**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 65 percent 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. District 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.

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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) 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.
- 1.
- H. The following sources may be useful in developing the Waste Management Plan:

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1. California Recycling Department, at www.dgs.ca.gov/BSC/CALGreen.
 2. General information contacts regarding construction and demolition waste:
 - a. Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies: www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf.
 - b. Additional resources to be developed by Contractor with assistance from District 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/.
 - 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) www.calrecycle.ca.gov.
 4. Recycling Economics Information: The above lists contain information that may be useful in estimating the costs or savings or recycling options.
- 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.

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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.

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- 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.

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- 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.
 - c. State the estimated net cost, versus landfill disposal.
 - 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

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- 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. Base conversion rate numbers 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, www.calrecycle.ca.gov/LGCentral/Library/Guidance.
 2. Submit Report on a form acceptable to District.
 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.

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- 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.

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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, District, 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.

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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

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Construction Waste Management and Disposal 01 74 19 - 10
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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
(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) | 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 |

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.
 - 2. Protex Products: www.protex-products.com.
 - 3. Surface Shields, Inc: 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.

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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.

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- 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

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**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. District 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 DSA 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 District.

1.03 DEFINITIONS

- A. Warranty: Assurance to District 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 District 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 District.
- 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 District.
- 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.

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1.04 SUBMITTALS

- A. Advance Submittals: For equipment and systems, or component parts of systems, put into service during construction and operated by District, submit documents within ten days of start of operation by District.
- B. Final Completion Submittals: Prior to application for final payment, Contractor shall submit 3 copies the following:
 - 1. Agency Document Submittals: Submit to District 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 DSA 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 District.
 - 2. Final Specifications Submittals: Submit to District 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 District 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 District, 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 District.

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- e. Comply also with other requirements of District, as directed.
 - f. All signatures shall be notarized.
5. Subcontractor List: Submit to two copies to District and two copies to Architect of updated Subcontractor and Materials Supplier List.
 6. Warranty Documents: Prepare and submit to District 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 District, 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 District's permission, submit documents within 10 days after acceptance.
 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, 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 District 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 District, Work performed under the Contract which is found to be defective during the Correction Period (warranty or guarantee) period.

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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 District, complying with applicable requirements of the Contract Documents.
 2. Contractor is responsible for all costs for replacing or reconstructing defective Work regardless of whether District has benefited from use of the Work through a portion of its anticipated useful service life.
- I. District's Recourse:
1. Written warranties made to the District 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 District can enforce such other duties, obligations, rights, or remedies.
 2. Rejection of Warranties:
 - a. The District 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. District 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.

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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 District.
- 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 District through Architect or Construction Manager.
 - 2. Measured depths of foundations in relation to finish first floor datum.

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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

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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:

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- 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 District 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 District'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.

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- 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 District's permission, leave date of beginning of time of warranty until Date of Substantial completion 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 District through Architect for approval prior to final execution.
 - 3. Refer to product Specifications Sections of Divisions 2 through 33 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 District.
 - 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 District 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 District beyond those specified, submit draft of guarantee to District through Architect for review and acceptance before performance of the Work.
 - 4. In other cases, submit draft of guarantee to District 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.

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- 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 District 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:

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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 District:
 - 1) By separate agreement with Contractor, prior to completion date established in the Certificate of Completion, submit properly executed warranties to District 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

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Closeout Submittals 01 78 00 - 11
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**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 New Kitchen & Weight Room 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 District '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 District , after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the District to have said defective Work repaired or replaced to be made good, and agree to pay to the District upon demand all moneys that the District 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) _____

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FORM LETTER

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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 [__ warrant__] [__ guarantee__] that the portion of the Work described above which [__ we have provided__] [__ was provided by (Installer or Subcontractor's Name)__] for New Kitchen & Weight Room 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 District'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 District, after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the District to have said defective Work repaired or replaced to be made good, and agree to pay to the District upon demand all moneys that the District 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

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END OF SECTION

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**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. Record Schedule of Values.
- G. 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: Construction Manager is to maintain one set of electronically marked-up PDF copy of the Contract Drawings including Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark Record Drawings 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 document.
 - 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.

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- d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference Record Drawings 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 Contract Drawings.
 - b. Revisions to details shown on Contract 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 District or Construction Manager.
 - 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 Drawings.
4. Mark Record sets with erasable, red text and graphics. 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 Contract 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: PDF, Version, Microsoft Windows operating system.

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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 Construction Manager 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 Construction Manager 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. Do not flatten the document.
 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 section 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 Construction Manager.
 - 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.

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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. Do not flatten the document.

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. Do not flatten the document.
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 District or Construction Manager at Project site to determine which Samples maintained during the construction period aer to be transmitted to District or Construction Manager for record purposes.
- B. Comply with District or Construction Manager's instructions for packaging, identification, marking, and delivery to District or Construction Manager'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. The extent of all open trenches and manholes.
 2. Identify all exposed utilities in the photos.
 3. Show photograph locations and dates on Record Drawings.

3.06 RECORD SCHEDULE OF VALUES

- A. Provide a PDF copy of the final Schedule of Values as indicated in Section 01 20 00 - Price and Payment Procedures.

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3.07 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.

3.08 SUBMISSION

- A. Keep Project Record Documents current, as they will be reviewed for completeness by Architect, Engineer, Project Inspector, and Construction Manager; 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 Construction Manager for review, approval and further processing.

3.09 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 Construction Manager to be in concert with approval of the monthly Application for Payment.
- C. Maintenance of Record Documents and Samples:

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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 Construction Manager reference during normal working hours.

3.10 FINAL SUBMITTAL/CLOSEOUT

- A. Contractor is to provide a complete coordinated set of electronic PDF Record Documents to the Architect as part of the final closeout procedure.

END OF SECTION

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**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 District 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. Conveying systems.
 - 6. Landscape irrigation.
 - 7. Items specified in individual product Sections.
- C. Training of District 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.
- B. Training Plan: District will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Each Sub, Design-Builder SubContractor and vendor responsible for training submits a written training plan to the Architect, District, Construction Manager, and Commissioning Authority for review and approval prior to training.
 - 2. Submit to Architect for transmittal to District.
 - 3. Submit not less than four weeks prior to start of training.
 - 4. Revise and resubmit until acceptable.

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5. Provide an overall schedule showing all training sessions.
6. 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 a 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 District'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.

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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 specific training requirements of District personnel by Subs, Design-Builder SubContractors and vendors is specified in the Division in which the equipment is specified.
- C. 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.

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 District.
- B. Demonstrations conducted during Functional Testing need not be repeated unless District personnel training is specified.
- C. Demonstration may be combined with District 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 Substantial Completion.
 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 Substantial Completion.

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. District 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.

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- 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 District's personnel to be trained; re-schedule training sessions as required by District; once schedule has been approved by District failure to conduct sessions according to schedule will be cause for District 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

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**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.
 - 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 District are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
 - 5. Verify that the District'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 Substantial 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 District.

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.

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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. Electrical Systems:
 - a. Power quality.
 - b. Emergency power systems.
 - c. Uninterruptible power systems.
 - d. Lighting controls other than manual switches.
6. Electronic Safety and Security:
 - a. Security system, including doors and hardware.
 - b. Fire and smoke alarms.
7. Communications:
 - a. Voice and data systems.
 - b. Public address/paging.
8. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
9. 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 District personnel training.

1.04 REFERENCE STANDARDS

- A. CSI/CSC MF - Masterformat.

1.05 SUBMITTALS

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

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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 District'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 District.
- 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 District.

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- 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 District; such equipment, tools, and instruments are to become the property of District.
- 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 District.

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.

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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:

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- 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.
- 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.

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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 District.
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 District; 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 District 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 District and Commissioning Authority personnel time witnessing re-testing.
 6. Contractor shall bear the cost of District 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

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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.
- F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, 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:

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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.

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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 CO2 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:

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- 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.

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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 District.
- 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 District.

END OF SECTION

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**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 District are complete: Detailed O&M data submittals are specified.
 - 4. Verify that the District'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 Substantial Completion.
- 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 District.
- 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 District'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.

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- 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 Substantial Completion, with District's approval, due to seasonal requirements, site conditions , or both, that prohibit the tests from being performed prior to achieving Substantial Completion.
- 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. District's Project Requirements (OPR): A written document that details the District'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 - HVAC&R Technical Requirements for the Commissioning Process.
- B. ASHRAE Std 202 - Commissioning Process for Buildings and 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 - Recommended Practice on Commissioning and Integrated Testing of Fire Protection and Life Safety Systems.

1.04 SUBMITTALS

- A. Commissioning Plan:
 - 1. Submit preliminary draft for review by District 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:

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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 District 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 District 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 District'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

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- I. Final Commissioning Report: Submit to District. 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 District’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 District’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.

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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 District's personnel above and beyond.
 14. Commissioning record table of contents.

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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.

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1. Prepared By: District.
 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. District'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.

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- B. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction Contract Documents; review and submit comments to District.
 - 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 District 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 District 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

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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."

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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.

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- 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.

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- 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 District personnel; hold meetings at least monthly.
- E. Submit periodic progress reports to District and Contractor.
- F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that District'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.

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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.

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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 District'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 District, 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 District 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.

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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

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- 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 Substantial Completion conduct on-site review with District'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

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**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. 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 District.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- 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.
- F. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- G. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.
- H. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- I. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

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

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1.04 DEFINITIONS

- A. Remove: Remove and legally dispose of items, except those identified for use in recycling, re-use, and salvage programs.
- B. 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.
- C. 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.
- D. 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.
- E. 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.
- F. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- G. 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.
- H. Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.
- I. 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.

1.05 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.

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- 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 DSA, supervisory and quality control personnel of Contractor and all subcontractors performing this and directly-related Work.
- D. Submit minutes of meeting to District, Project Inspector and Architect, for Project record purposes.
- E. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.
 - 1. Refer to sequence requirements specified in Section 01 10 00 - Summary; and construction progress schedule requirements specified in Section 01 32 16 - Construction Progress Schedule.

1.06 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain property of Grossmont Union High School District, 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 District or DSA and other designated representatives to review any salvagable items to determine if District wants to retain ownership, and discuss Contractor's Waste Management and Recycling Plan.

1.07 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
 - 2. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit 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.

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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 District's approval for noise considerations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

- A. Remove paving and curbs as required to accomplish new work.
- B. Remove other items indicated, for salvage, relocation, and recycling.

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.

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- 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 DSA, Project Inspector and Architect.
- D. Comply with other requirements specified 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. Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.
 3. Temporary Construction: Remove indications of temporary construction facilities, such as haul roads, work areas, structures, stockpiles or waste areas.
 4. 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.
 5. 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.

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- c. Properly maintain equipment to reduce gaseous pollutant emissions.
- 6. 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. Repetitive impact noise on the property shall not exceed the following dB limitations:

Sound Level in dB	Time Duration of Impact Noise
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

- b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements of this Contract.
- c. At least once every five successive working days while work is being performed above 55 dB noise level, measure sound level for noise exposure due to the demolition.
 - 1) Measure sound levels on the 'A' weighing network of a General Purpose sound level meter at slow response.
 - 2) To minimize the effect of reflective sound waves at buildings, measurements may be taken three to six feet in front of any building face.
- 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 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

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01 50 00 - Temporary Facilities and Controls.

- 1) Review location and type of construction of temporary barriers with District and/or the DSA.
 - 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 and with permission of DSA (AHJ 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 permit.
 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 District.
- I. Do not begin removal until built elements to be salvaged or relocated have been removed.
- J. Protect existing structures and other elements that are not to be 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.
- K. 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.
- L. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.
- M. 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.
- N. 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.
- O. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

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P. 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 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. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to District.
- 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 District.
- 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 utilities to be subsequently reconnected, in same manner as other utilities to remain.
- I. Utility Lines, Posts and Structures:
 - 1. Work by Utility: Posts, conductors, guy wires, boxes, structures and equipment shown to be cleared or removed by the responsible utility company or agency shall be considered work under a separate contract.
 - 2. Coordination: The Contractor shall arrange, schedule and coordinate work by utility companies and agencies.
 - 3. Payment: Costs, if any, imposed by utility companies and agencies shall be included in the Contract Sum.

3.04 DEWATERING

- A. Dewatering: Dewater site in localized areas as Work progresses.
 - 1. Provide an adequate system to lower and control groundwater in order to permit excavation, construction of structures, and placement of fill materials under dry conditions.
 - 2. Install sufficient dewatering equipment to pre-drain waterbearing strata above and below bottom of structure foundations, drains, sewers, and other excavations.
 - 3. Maintain excavations free of standing water.
 - 4. Provide dewatering 24 hours per day in advance of placement of concrete.
 - 5. Allow no concrete to be placed in standing water.
 - 6. Ensure that trenching and excavations do not cave in due to water.
- B. Surface Run-off Water Control:

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1. Minimize flow of ground water from adjacent areas into Work areas.
 2. Do not restrict flow from adjacent properties such that natural flow is hindered.
- C. Water Disposal:
1. Dispose of run-off by legal means and as acceptable to authorities having jurisdiction.
 2. Dispose of water removed from excavations in a manner to avoid endangering public health, property, and portions of Work under construction or completed.
 3. Dispose of water in a manner to avoid inconvenience to others engaged in work about site.
 4. Provide sumps, sedimentation tanks, and other flow control devices as required by authorities having jurisdiction.

3.05 PORTLAND CEMENT CONCRETE AND ASPHALTIC CONCRETE PAVING DEMOLITION

- A. Cutting: Make a saw cut at edges of existing paving to be removed, where portions of existing paving are indicated to remain.
- B. Cutting Method: When adjacent to new paving, cut with abrasive type, water-cooled saw to a minimum depth of 1-1/2 inches. Cut lines straight and square to face of paving.
- C. Aggregate Base: Existing aggregate base may be retained except where landscaping and overexcavation are indicated.
- D. Concrete Removal: Break concrete and remove debris. Preserve straight cut.
- E. Disposal: Remove debris from the site except where allowed or directed for fill for subsequent earthwork or for landscape walls.

3.06 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- 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

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

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Openings for other work.
- B. Form accessories.
- C. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.
- C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.
- D. Section 05 31 00 - Steel Decking: Placement of steel anchors in composite decking.
- E. Section 05 50 00 - Metal Fabrications: Placement of embedded steel anchors and plates in cast-in-place concrete.
- F. Section 31 23 16 - Excavation: Shoring and underpinning for excavation.
- G. 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. PS 1 - Structural Plywood.
- F. 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.

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- 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.

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- 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. Softwood Plywood for Concealed Surfaces: PS 1, undamaged face C Grade, Group 2 Plugged EXT or APA Structural I Sheathing.
- B. Hardboard: For curved surfaces, tempered hardboard, Masonite Corp., or equal.
- C. 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.
- D. 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. Composition: Colorless, reactive, water-based or solvent-based compound.
 - 2. Do not use materials containing diesel oil or petroleum-based compounds.
 - 3. Does not impair subsequent treatments of concrete surfaces or bond of applied coatings.
 - 4. VOC Content: In compliance with applicable local, State, and federal regulations.
 - 5. Products:
 - a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.
 - b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- D. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 50 00.
- E. 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).

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- c. Aztek (877/531-3344).
- d. 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.

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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 District.

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.

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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.

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- 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.

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- 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

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

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.

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- 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.

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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, 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.

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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.

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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.

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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

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**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. 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 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- 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 C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- O. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

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- 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 C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- 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 C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- Y. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- Z. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- AA. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- BB. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
- CC. 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.
- DD. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- EE. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- FF. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

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.

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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.
 3. Mix Design: Submit mix designs prepared, stamped and signed by a Civil Engineer licensed in the State of California.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. 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.
- F. Test Reports: Submit report for each test or series of tests specified.
- G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in District'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

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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 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.

1.07 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, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 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. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.
- D. 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.

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.

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2.03 CONCRETE MATERIALS

- A. 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.
- B. 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.
 - 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.
- C. 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.
 - b. 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.
 - 2. Products:
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Water Reducing Admixture: ASTM C494/C494M Type A.
 - 1. Products:
 - a. Euclid Chemical Company; EUCON NW: www.euclidchemical.com/#sle.
 - b. 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. 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 ft²/24 hours or lower.

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- a. Alternative test methods shall be acceptable to the finish flooring manufacturer and installer.
- 2. 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.
- 3. Products:
 - a. Barrier One Concrete Admixtures; MVRA-CPS: www.barrierone.com/#sle.
 - b. Hycrete, Inc: www.hycrete.com/#sle.
 - c. ISE Logik Industries, Inc; MVRA 900: www.iselogik.com/#sle.
 - d. Specialty Products Group; Vapor Lock 20/20: www.spggogreen.com/#sle.
 - e. 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. Fortifiber Building Products Systems; Moistop Ultra 15, 15 mils thick (0.010 max. permeance), Class A, unreinforced polyolefin: www.fortifiber.com.
 - b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
 - c. Raven Industries; VaporBlock VB15, 15 mils thick (0.01 perms), Class A, unreinforced polyolefin: ravenefd.com,
 - d. Reef Industries, Inc.; Vaporguard, 15 mil (E-96 0.000 perms), Class B: www.reefindustries.com
 - e. Stego Industries, LLC; Stego Wrap Vapor Barrier, 15 mils:: www.stegoindustries.com/#sle.
 - f. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.

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- 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.
 - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; DURAGROUT: www.laticrete.com/our-products/concrete-construction-chemicals/#sle.
 - c. SpecChem, LLC; SC Precision Grout: www.specchemllc.com/#sle.
 - d. W. R. Meadows, Inc; 588-10K: www.wrmeadows.com/#sle.
 - e. W. R. Meadows, Inc; 1428 HP: www.wrmeadows.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
 7. Low-Slump, Dry Pack Products:
 - a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Duragrout: www.lmcc.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.
1. Composition: High solids content material exhibiting positive expansion when tested in accordance with ASTM C827/C827M.
 - a. Maximum Height Change: Plus 4 percent.
 - b. Minimum Height Change: Plus 1 percent.
 2. Minimum Compressive Strength at 7 days, ASTM C579: 12,000 pounds per square inch.
 3. Minimum Compressive Strength at 7 days, ASTM D695: 12,000 pounds per square inch.
 4. Products:
 - a. Euclid Chemical Company; E3-DEEP POUR: www.euclidchemical.com/#sle.
 - b. Dayton Superior Corporation; [____]: www.daytonsuperior.com/#sle.
 - c. Five Star Products, Inc; Five Star DP Epoxy Grout: www.fivestarprouducts.com/#sle.
 - d. W. R. Meadows, Inc; REZI-WELD 3/2: www.wrmeadows.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

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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.
 - b. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
 - c. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.
 - d. 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.
 - b. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com/#sle.
 - c. Euclid Chemical Company; DURALFLEX GEL: www.euclidchemical.com/#sle.
 - d. Euclid Chemical Company; DURALFLEX LV: www.euclidchemical.com/#sle.
 - e. Euclid Chemical Company; DURAL 452 GEL, DURAL 452 LV, or DURAL 452 MV: www.euclidchemical.com/#sle.
 - f. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - g. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS: 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.
 - i. 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.
 - b. 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.
 - b. 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

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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.
 - b. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.
 - c. Nox-Crete Inc; Monofilm: www.nox-crete.com/#sle.
 - d. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: www.specchemllc.com/#sle.
 - e. W. R. Meadows, Inc ; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
 - f. 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.
 - b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com/#sle.
 - c. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 4. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 5. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 6. VOC Content: Less than 100 g/L.
 7. Solids Content: 25 percent, minimum.
 8. Products:
 - a. Floor Seal Technology, Inc; VaporSeal 309 System: www.floorseal.com/#sle.
 - b. Nox-Crete Inc; Cure & Seal 1200E: www.nox-crete.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.

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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.
 - b. W. R. Meadows, Inc; CS-309-25 OTC: www.wrmeadows.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Curing and Sealing Compound, High Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
 1. Vehicle: Solvent-based.
 2. Solids by Mass: 25 percent, minimum.
 3. Products:
 - a. SpecChem, LLC; Cure and Seal WB 30: www.specchemllc.com/#sle.
 - b. W. R. Meadows, Inc; VOCOMP-30: www.wrmeadows.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Moisture-Retaining Sheet: ASTM C171.
 1. Curing paper, regular.
 2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
- F. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.
- G. Water: Potable, not detrimental to concrete.

2.08 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 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. Water-Cement Ratio: As indicated on Structural Drawings.
 3. Maximum Slump: As indicated on Drawings (S0-0.1).
 4. 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.

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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.

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- 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.

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3.04 PLACING CONCRETE

- A. Notify District'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.

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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.

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- 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.

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- 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.

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- 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.

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- 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 DSA 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

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**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-1.

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.
- B. Section 03 30 00 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

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 Construction Manager.

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. 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.

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- 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 Substantial Completion.
- 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.

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- B. Liquid Densifier and Hardener:
 1. Use at following locations: concrete floors on grade.
- C. Clear Coating:
 1. Use at following locations: Concrete floors with sealer, CONC-1.
- D. Slip Resistant Coating: Finely-ground aggregates added to coatings.

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.
 - b. Eco Safety Products; Ecoprocote-EcoEtch Pro Concrete Etcher & Cleaner: 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.
 - 2) Euclid Chemical Company; ULTRASIL LI+: www.euclidchemical.com/#sle.
 - 3) PROSOCO, Inc; ColorHard used with Consolideck LS or LS/CS: www.prosoco.com/consolideck/#sle.
 - 4) W. R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com/#sle.
 - 5) 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.
 - 2) Euclid Chemical Company; EUCOSIL: www.euclidchemical.com/#sle.
 - 3) L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; SEAL HARD: www.lmcc.com/#sle.
 - 4) Nox-Crete Inc; Duro-Nox: www.nox-crete.com/#sle.
 - 5) Paul M. Wolff Co.; SHUR-HARD: www.paulwolffco.com.

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- 6) SpecChem, LLC; Cure Hard: www.specchemllc.com/#sle.
 - 7) W. R. Meadows, Inc; Liqui-Hard: 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.
 - 2) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

2.05 COATINGS

- A. Penetrating Sealer: Transparent, nonyellowing, water-based coating. CONC-1
- 1. Composition: Hybrid.
 - a. Products:
 - 1) Ameripolish, Inc; 3D SP Concrete Sealer: www.ameripolish.com/#sle.
 - 2) Aqua-Mix; Sealer's Choice Gold: www.custombuildingproducts.com.
 - 3) Curecrete Distribution, Inc; Ashford Formula: www.curecrete.com/#sle.
 - 4) Glaze N' Seal; Glaze N' Seal Multi-Purpose Sealer : 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.
 - 6) Paul Wolff Co.; Royal-Sheen: www.paulwolff.com
 - 7) Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Composition: Epoxy.
 - a. Products:
 - 1) Arizona Polymer Flooring; Epoxy 100 : www.apfepoxy.com.
 - 2) Rustoleum Corporation; Product - Water Based Epoxy 6010 System : www.rustoleum.com. Also available through Vista Paint, www.vistapaint.com.
 - 3) Tnemec; Enviro-Pox Series 287 Base Coat / Everthane Series 248 Top-Coat : www.tnemec.com.
 - 4) 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.
 - b. Euclid Chemical Company; EUCO GRIP: www.euclidchemical.com/#sle.
 - c. SpecChem, LLC; Surface Grip: www.specchemllc.com/#sle.
 - d. W. R. Meadows, Inc; Sure-Step: www.wrmeadows.com/#sle.
 - e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

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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

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**SECTION 04 05 11
MASONRY MORTARING AND GROUTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry. M-1
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.
- B. ASTM C91/C91M - Standard Specification for Masonry Cement.
- C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- D. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- E. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
- F. ASTM C476 - Standard Specification for Grout for Masonry.
- G. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- H. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
- I. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.
 - 1. Use 2016 as indicated in 2019 CBC Ch. 35 Referenced Standards.
- J. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- D. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

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1.05 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.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or CBC Chapter 21A building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.
 - 1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.
- B. Mortar Color: M-1.
- C. Mortar Mix Designs: ASTM C270, Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, Non-loadbearing Masonry: Type S.
 - 3. Interior, Loadbearing Masonry: Type S.
- D. Grout Mix Designs:
 - 1. Comply with CBC 2103A.3.1.
 - 2. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
 - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
 - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
 - 3. Engineered Masonry: Compressive strength at 28 days: as indicated on Drawings; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
 - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
 - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.02 MATERIALS

- A. All materials to conform to CBC, Section 2103A.2 and 2103A.3.
- B. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the

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specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Type S.
 2. Color: Standard gray.
- C. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
1. Type: Fine.
- D. M-1 Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
- E. Water: Clean and potable.
- F. Bonding Agent: Latex type.

2.03 MORTAR MIXING

- A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.
- B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- C. Maintain sand uniformly damp immediately before the mixing process.
- D. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- E. Do not use anti-freeze compounds to lower the freezing point of mortar.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
1. Per DSA IR 21-2.13, revised 3/3/16 (modified for 2016 CBC):
 - a. The grout mix shall comply with the requirements of CBC, Section 2103A.3.
 - 1) All cells shall be solidly filled with grout in reinforced hollow unit masonry per CBC Section 2104A.1.3.
 - 2) A coarse grout shall be used in grout spaces 2 inches or more in width and in all grouted cells of hollow unit masonry, per CBC Section 2103A.3.
 - b. Sufficient water may be added to make a workable mix that will flow into all voids of the masonry without separation or segregation.
 - 1) The slump of the grout shall be 8 to 11 inches per TMS 402/602, Article 2.6 B.2 and ASTM C476, Section 4.2.2.
 - c. Grout mixes shall contain an approved admixture conforming to the requirements of this specification. Admixture shall be used in strict accordance with the manufacturer's instructions and appropriate listing from ICC-ES or other acceptable

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evaluation agency per IR A-5.

- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
 - 1. Basis of Design Product: Grout Aid as manufactured by Sika, or approved equal.
 - 2. Admixtures shall meet the requirements of CBC Section 2103A.5 and have an evaluation report meeting the requirements of IR A-5.
 - 3. The approval of the Architect or structural engineer and DSA is required for the use of any admixture.

PART 3 EXECUTION

3.01 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

3.03 GROUTING

- A. Perform all grouting by means of low-lift technique. Do not employ high-lift grouting.
- B. Low-Lift Grouting:
 - 1. Conform to CBC 2104A.1.3.1.
 - 2. Limit height of pours to 48 inches.
 - 3. Limit height of masonry to 16 inches above each pour.
 - 4. Pour grout only after vertical reinforcing is in place; horizontal reinforcing to be in place prior to grout being poured. Prevent displacement of bars as grout is poured.
 - 5. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. When grouting is stopped for more than one hour, terminate grout minimum 1-1/2 inch, 2 inches maximum below top of upper masonry unit to form a positive key for subsequent grout placement.
- D. Solid grout all cells and courses, no exceptions. Consolidate with 3/4 inch diameter mechanical vibrator inserted into each and every cell.
 - 1. Reconsolidate after the block has absorbed some of the water in the grout, but before the grout has lost plasticity.

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00 - Quality Requirements.
- B. Testing of mortar and grout: Conform to the requirements of CBC, Section 2105A.3.

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- C. Test and evaluate mortar in accordance with ASTM C780 procedures.
 - 1. Test with same frequency as specified for masonry units.
- D. Test and evaluate grout in accordance with ASTM C1019 procedures.
 - 1. Test with same frequency as specified for masonry units.

END OF SECTION

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**SECTION 04 20 00
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block. CMU-1
 - 1. Applications: Trash Enclosure and Site Walls.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 05 11 - Masonry Mortaring and Grouting.
- C. Section 07 25 00 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.
- D. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- E. 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 C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
- C. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.
- D. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar.
- E. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
- F. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry.
- G. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.
- H. DSA, Interpretation of Regulations Document IR 21-2.13 - Concrete Masonry High Lift Grouting Method.

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.

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- 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. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- G. Installer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for District'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 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.

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2. Orco Block Co.: www.orco.com.
 3. RCP Block and Brick: 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.
 - 1) CMU-1: Shot-Blasted; Color: 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.
 - g. Performance of Units with Integral Water Repellent:
 - 1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
 - (a) No water visible on back of wall above flashing at the end of 24 hours.
 - (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
 - (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
 - 2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
 - 3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
 - 4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
 - h. Use only in combination with mortar that also has integral water repellent admixture.
 - i. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 05 11.

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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.
 - b. Dur-O-Wal: www.dur-o-wal.com.
 - c. Hohmann & Barnard, Inc: www.h-b.com.
 - d. WIRE-BOND: 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.
 - b. WIRE-BOND: 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, 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, or equal.
 - 5. Cleaner for Asphalt and Tar: For removing asphalt, tar, grease, hydraulic oil, motor oil and similar materials from porous masonry.

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- a. Basis of Design Product: Sure Klean Asphalt & Tar Remover as manufactured by ProSoCo, Inc., 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, or equal.
- E. Water Repellent: Water-based silane or siloxane masonry water repellent.
 - 1. See Section 07 19 00 - Water Repellents.
 - 2. Use a non-sacrificial product list in Section 09 96 23 - Graffiti-Resistant Coatings.

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 2104A 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.

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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: Stacked.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
 - a. Flush at ball walls.

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 WYTHE 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.

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- 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 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.

3.08 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.

3.09 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 District.
- 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.

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3.10 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.

3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Inspection and Core Tests shall be per CBC 1705A.4 and 2105A.4.

3.12 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.

3.13 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.

3.14 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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**SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Structural steel support members.
- C. Base plates, shear stud connectors and expansion joint plates.
- D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. 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 A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- 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 A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (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.

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- 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 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.
- Y. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- Z. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- AA. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- BB. AWS D1.8/D1.8M - Structural Welding Code - Seismic Supplement.
- CC. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.
- DD. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.
- EE. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- FF. SSPC-SP 2 - Hand Tool Cleaning.
- GG. SSPC-SP 3 - Power Tool Cleaning.
- HH. 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.

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- 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. Maintain one copy of each document on site.
- C. Fabricator: Company specializing in performing the work of this section with minimum five years of documented experience.
- 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.
- E. 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.
- F. Erector: Company specializing in performing the work of this section with minimum five years of documented experience.
- G. Inspection: The District 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).

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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. Structural Bolts and Nuts: As indicated on Structural Drawings.
- H. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- I. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.
- J. 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.
- K. 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.
- L. 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."
- M. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

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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 field welded or in contact with concrete.
- 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 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.

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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 all field-welded connections and test at least 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 (Division of the State Architect) 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.

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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

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**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.

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. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures.
- B. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. 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.
- H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- I. ASTM F594 - Standard Specification for Stainless Steel Nuts.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

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- M. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.
- N. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.
- O. SSPC-SP 3 - Power Tool Cleaning.
- P. SSPC-SP 5 - White Metal Blast Cleaning.
- Q. SSPC-SP 6 - Commercial Blast Cleaning.
- R. SSPC-SP 10 - Near-White Metal Wet Abrasive Blast Cleaning.
- S. 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.

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.

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- 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.

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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 Construction Manager and Architect.
- C. 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.
- D. 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

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pipe receivers cast into concrete at both open and closed positions (both leaves).

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.

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 DSA approval.

B. Materials:

1. Interior Use: For use in conditioned environments free from potential moisture, provide zinc plated carbon steel anchors.
2. 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.
3. 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:

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.

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- 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:
- 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.

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.

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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.

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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.

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- 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.

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- 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

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**SECTION 05 59 20
TUBE STEEL ENCLOSURE AND GATES**

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Tube steel enclosure.
- B. Pedestrian gates.
- C. Vehicle and equipment access gates.
- D. Excavation for post bases; concrete foundation for posts.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Non-insulated exterior doors.
- C. Section 09 96 00 - High-Performance Coatings: Field applied exterior metal coatings
- D. Section 31 23 16 - Excavation: Excavation for footings.

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. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- D. 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.
- E. 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.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel.

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- L. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.
- M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

1.04 SUBMITTALS

- A. Product data in the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, hardware and accessories specified in the section.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Gates and hardware, including accessible gate lever lockset.
 - 3. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- B. Shop Drawings:
 - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: 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."
- B. Coordination: Provide templates and sleeves for incorporation of embedded items into the Work specified in other Sections.
- C. Field-Verified Dimensions: Prior to fabrication, field verify dimensions and details of construction. Immediately report variances in writing to Construction Manager and Architect.
- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel or equal.
- E. Welder's Qualifications:
 - 1. 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.
 - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.

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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 1008.2, 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 DESIGN CRITERIA

- A. Metal Plate Wall Panels System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior wall panels and subgirt framing assembly.
 - 2. 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.
 - 3. Design Pressure: In accordance with ASCE 7.
 - 4. Intermediate Panel Stiffeners: Provide as required by design loads applied to panels, and secured to rear face of panel by welding per AWS D1.2/D1.2M; of size and strength to maintain panel flatness.
 - 5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when

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subject to 100 degrees F seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

2.03 MANUFACTURED METAL PANELS

- A. Metal Plate Wall Panels:
 1. Orientation: Vertical and horizontal; style as indicated.
 2. Joint Layout: As indicated on Drawings.
 3. Material: Aluminum, 0.125 inch minimum thickness.
 4. Perforation Pattern.
 - a. Hole Size: 3/4 inch diameter.
 - b. Hole Spacing: 1-1/4 inch. staggered centers.
 - c. Open Area: 58 percent.
 5. Panel Width: As indicated on drawings.
- B. Subgirts: C-shaped furring channel; to attach wall panel system to face of building structural wall.
 1. 8 gage, 0.125 inch thick formed aluminum sheet.
- C. Fasteners: Provide of aluminum, galvanized steel, or stainless steel material.

2.04 MATERIALS

- A. Aluminum Plate: ASTM B209 (ASTM B209M), 3003 alloy, H14 temper.
 1. Surface Texture: Smooth.
- B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.
 1. Square and Rectangular Hollow Structural Sections (HSS): $F_y = 46$ ksi.
- C. Steel Sheet:
 1. Hot-Rolled: ASTM A1011/A1011M.
 2. Cold-Rolled, ASTM A1008/A1008M.
- D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.05 ENCLOSURE GATES

- A. Gates: Located as shown on the Drawings.
- B. Gate Posts: As indicated on Drawings.
- C. Gate Frame and Brace: As indicated on Drawings.

2.06 HARDWARE

- A. All gate drop rod assemblies are to use a 5/8 inch diameter solid steel center stop.

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1. Provide a 4 inch deep steel sleeve/receiver.
 2. In asphalt areas secure sleeve in a 12 inch diameter by 18 inch deep concrete footing.
- B. Gate Hinges: Size as required for weight of gate, plus 20 percent. Each hinge to be capable of the entire weight of the gate panel.

2.07 FINISHES

- A. Tubular Steel Framework: Paint per Section 09 96 00 - High-Performance Coatings.
- B. Aluminum Panels:
1. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.
 - a. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as indicated on drawings.
 - 1) Manufacturers:
 - (a) PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
 - (b) Sherwin-Williams Company; SHER-NAR 5000: oem.sherwin-williams.com/#sle.
 - (c) Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.
 - (d) Substitutions: See Section 01 60 00 - Product Requirements.
 2. Back Side Coating: Same as front face.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.08 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- B. Extruded Aluminum: Comply with ASTM B221 (ASTM B221M).
- C. Fasteners: Manufacturer's standard type to suit application; galvanized metal with soft neoprene washers.
 1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.
- D. Field Touch-up Paint: As recommended by panel manufacturer.
- E. Bituminous Paint: Asphalt based.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.02 PREPARATION

- A. Stake locations of gates and ensure footings will not conflict with any utilities, easements, or footings.
- B. If conflict occurs immediately alert General Contractor.

3.03 ON THE JOB SITE

- A. After the gate has been erected and is mechanically complete, wire brush field welds, dry wipe off all loose residue, spot prime with the Zinc Chromate all bare metal, bare spots and chips, and unpainted surfaces.

3.04 FABRICATION AND INSTALLATION

- A. Gates shall be welded and have smoothed, clean, slag free welds. Dimensions and installation shall be in accordance with the drawings.
- B. Gates shall be set square and plumb.

3.05 POST SETTING

- A. General: Comply with ACI 301 for cast-in-place concrete.
- B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
 - 1. Concrete Mixes: Normal-weight concrete with not less than 3000-psi (20.7- MPa) compressive strength (28 days), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum size aggregate.
- C. All posts to be set in concrete as detailed on the drawings.

3.06 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by the manufacturer in writing for exterior applications.

3.07 SITE CLEAN UP

- A. The construction site shall be cleaned up and all accumulated debris removed by the Contractor.

END OF SECTION

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**SECTION 06 05 73
WOOD TREATMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Site applied termiticide for wood materials.
- B. Site applied termiticide for other building materials.
- C. Site applied mildewcide for wood materials.
- D. Site applied preservative treatment for wood materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions .
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 06 10 00 - Rough Carpentry: Factory treatment for wood products.
- D. Section 06 17 33 - Wood I-Joists: Factory treatment for wood products.
- E. Section 06 18 00 - Glued-Laminated Construction: Factory treatment for wood products.

1.03 REFERENCE STANDARDS

- A. AWWA U1 - Use Category System: User Specification for Treated Wood.

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. Warranty: Submit manufacturer warranty and ensure that forms have been completed in District'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.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Site Applied Termiticide and Mildewcide: Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for termite reinfestation.

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PART 2 PRODUCTS

2.01 SITE-APPLIED WOOD TREATMENT

- A. Manufacturers:
 - 1. Arch Wood Protection, Inc: www.wolmanizedwood.com.
 - 2. Green Products Company; Copper Green: greenproductsco.net.
 - 3. Nisus Corporation: www.nisuscorp.com/#sle.
 - 4. Osmose, Inc: www.osmose.com.
 - 5. Viance, LLC: www.treatedwood.com.
- B. Site Applied Termiticide for Wood: Borate mineral salt based, spray applied, penetrating termiticide.
 - 1. Products:
 - a. Nisus Corporation; Bora-Care: www.nisuscorp.com/#sle.
- C. Site Applied Termiticide and Mildewcide: Borate mineral salt based, spray applied termiticide, mildewcide and mold growth preventative.
 - 1. Products:
 - a. Nisus Corporation; Bora-Care: www.nisuscorp.com/#sle.
- D. Site Applied Termiticide for Wood, Steel and Concrete: Borate mineral salt based, spray applied termiticide formulated for use on wood, steel, concrete and other building materials.
 - 1. Active Ingredient: 40% minimum disodium octaborate tetrahydrate (DOT).
 - 2. Carrier and Penetrant: Proprietary glycol solution.
 - 3. Products:
 - a. Nisus Corporation; Bora-Care: www.nisuscorp.com/#sle.
- E. Site Applied Mold Cleaner: Non-bleaching, oxidizer based formula with high-pH tolerant surfactant. Contains no sodium hydroxide or sodium hypochlorite.
 - 1. Products:
 - a. Nisus Corporation; Bora-Care with Mold-Care: www.nisuscorp.com/#sle.
- F. Surface-Applied Wood Preservative: Pressure treatment in accordance with AWPA U1, using water borne preservative.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove dust, dirt and other contaminants from treatment surfaces. Remove tarpaulins, dropcloths, strippable protective films, etc., from areas to be treated. Move equipment and stored materials that block or prevent product application.

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3.02 INSTALLATION - GENERAL

- A. Provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 SITE APPLIED WOOD TREATMENT

- A. Comply with manufacturers written mixing and installation instructions.
- B. Termiticide: Apply to foundations, structure and other items as listed.
 - 1. All structural wood and sill plates within 24 inches, minimum, of point of contact with foundation.
 - 2. All wood, wood based and cellulosic sheathing within 24 inches, minimum, of point of contact with foundation.
 - 3. Concrete foundations 2 inches, minimum, from sill plate.
 - 4. All pipe and plumbing penetrations up to 24 inches, minimum, above slab and slab surface within 6 inches, minimum, of pipe or penetration.
 - 5. Concrete or masonry basement walls up to 24 inches, minimum, from top of soil.
 - 6. Six inches, minimum, on either side of control joints and construction joints in slabs and joints between slabs and abutting material.
- C. Mildewcide: Apply to wood and wood based building materials as listed.
 - 1. All structural wood and sill plates within 24 inches, minimum, of point of contact with foundation.
 - 2. All wood, wood based and cellulosic sheathing within 24 inches, minimum, of point of contact with foundation.

END OF SECTION

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**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. Roof-mounted curbs.
- F. Roofing nailers.
- G. Preservative treated wood materials.
- H. Miscellaneous framing and sheathing.
- I. Communications and electrical room mounting boards.
- J. Concealed wood blocking, nailers, and supports.
- K. 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 12 00 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- D. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- E. Section 06 17 33 - Wood I-Joists.
- F. Section 06 18 00 - Glued-Laminated Construction.
- G. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood.
- D. PS 1 - Structural Plywood.
- E. PS 2 - Performance Standard for Wood Structural Panels.
- F. PS 20 - American Softwood Lumber Standard.
- G. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17.

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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. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.
- D. Evaluation Service Reports: Show compliance with specified requirements.
- E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

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.
- B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. 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.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. 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. Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: No. 1 & Better.

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- D. 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.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 1 or Construction Grade.
 - 2. Boards: No. 2 or Standard Grade.

2.03 STRUCTURAL COMPOSITE LUMBER

- A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.
- B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer and ESR Report.
 - 1. Columns: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): 2,000,000 psi, minimum.
 - 2. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): 2,000,000 psi, minimum.
 - 3. Headers Not Longer Than 48 inches: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber.
 - 4. Manufacturers:
 - a. Boise Cascade Company: www.bc.com.
 - b. Georgia-Pacific Corp.: www.buildgp.com.
 - c. RedBuilt; RedLam LVL: www.redbuilt.com
 - d. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 CONSTRUCTION PANELS

- A. Roof Sheathing: Any PS 1 type, rated Structural I Plywood Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 24.
 - 3. Performance Category: 15/32 PERF CAT.
 - 4. Edge Profile: Square edge.
- B. Wall Sheathing: Any PS 2 type plywood.
 - 1. Bond Classification: Exterior.
 - 2. Grade: Structural I Sheathing.
 - 3. Span Rating: 24.
 - 4. Performance Category: 15/32 PERF CAT.

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- 5. Edge Profile: Square edge.
- C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 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.
- D. 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.

2.05 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.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
 - 3. Anchors: As indicated on Drawings, see also Section 05 05 19.
- 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. Sill Flashing: See Section 07 62 00.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Coordinate installation of rough carpentry members specified in other sections.

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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.
- 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 ASTM F594, ASTM F593, and applicable codes.
 - 1.
- 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 metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- 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.

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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.

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 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.
- 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. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

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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

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**SECTION 06 17 33
WOOD I-JOISTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood I-joists for roof framing.
- B. Bridging, bracing, and anchorage.
- C. Framing for openings.
- D. Preservative treatment of wood.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 10 00 - Rough Carpentry: Installation requirements for miscellaneous framing.
- C. Section 06 10 00 - Rough Carpentry: Material requirements for blocking, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

- A. ASTM D5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood.

1.04 DESIGN REQUIREMENTS

- A. Joists shall be sized and detailed to fit the dimensions and loads indicated on Drawings.
- B. Designs shall be in accordance with allowable values and section properties assigned and approved by the building code.
- C. Design of joists shall be verified upon request of Architect by submission of complete calculations.
- D. Blocking and bracing shall be provided to stabilize joists during fabrication, wind uplift, use of bottom chord for splay wires, or any other type of support.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.
- C. Shop Drawings: Indicate sizes and spacing of joists, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between joists.
 - 1. Shop Drawings show all critical dimensions for determining fit and placement in the building as well as loads the members are designed to support. Review of shop drawings

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shall be completed prior to fabrication. Drawings shall be prepared by a Civil or Structural Engineer Licensed in California.

2. Calculations: Submit structural calculations prepared by a Civil or Structural Engineer licensed in California.
- D. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
 1. Documented experience includes manufacturing and delivering specified products to projects of similar size and scope in California.
 2. Manufacturer shall have a current ICC Evaluation Report for the products provided.
 3. Products shall be fabricated in a facility licensed by the Los Angeles Department of Building and Safety.
- B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
- C. Regulatory Requirements:
 1. Conform to California Building Code (CBC), Title 24, Part 2, Chapter 23 with additional requirements for Division of the State Architect.
 2. Manufacturer to provide current valid evaluation report..
- D. In addition to conforming with all applicable Codes and regulations, manufacture joists in a plant approved for fabrication by Division of the State Architect, and to follow the guidelines of the evaluation report.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Piece mark and wrap joists in packages before arrival at jobsite.
- B. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.
- C. Protect products from damage due to weather and breakage.
- D. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks.
- E. Handle individual joists in the upright position.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood I-Joists:
 1. Basis of Design and DSA Approval: RedBuilt I-Joist, ICC ESR-2994 (Formerly Trus-Joist; iLevel by Weyerhaeuser): www.redbuilt.com, or approved equal.
 2. Boise Cascade Company: www.bc.com/#sle. ICC ESR-1144, ESR-1336, and VAR-1017.

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3. Louisiana-Pacific Corporation: www.lpcorp.com/#sle. ICC ESR-1305
4. Weyerhaeuser Company: www.weyerhaeuser.com/#sle. ICC ESR-1153 and VAR-1008.
5. Substitutions: See Section 01 60 00 - Product Requirements.
 - a. Substitution may or may not be accepted after Architect and District 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 DSA review and approval.
 - c. Substitutions may be acceptable, based on Architect's review and approval, for submittal to DSA. If substituted manufacturer cannot reproduce DSA 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 DSA submittal and DSA approval is required prior to installation.

2.02 MATERIALS

- A. Wood I-Joists: Laminated veneer lumber top and bottom flanges and oriented strand board (OSB) webs bonded together with structural adhesive, with published span rating to meet project requirements.
 1. Size and type, plus load and deflection criteria, shall be as indicated on Drawings.
 2. Wood Chord Members:
 - a. Micro-laminated LVL per ICC Report ESR-2993, moisture content of 7-16 percent at time of fabrication, or equal.
 3. Web: As indicated in ESR Report.
 - a. Oriented Strand Board (OSB), meeting PS2, Exposure 1.
 4. Span Rating: Established and monitored in accordance with ASTM D5055 by independent inspection agency.
 5. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
 - a. Provide I-joists manufactured without urea formaldehyde.
 6. Depth: As indicated on drawings.
 7. Fabrication:
 - a. Verify dimensions and site conditions prior to fabrication.
 - b. Fabricate with continuous chords.
 - c. Install web with ends jointed to form a continuous web.
 - d. Apply adhesive to groove centered in wide face of flange and pressure form and fit web into groove.
 - e. Include all extended ends and ceiling extensions, headers, bridging, shear blocks and panels, end supports, and end anchors required for complete installation.
 8. Fabrication Tolerances:

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- a. Flange Width: Plus/minus 1/32 inch.
 - b. Flange Thickness: Minus 1/16 inch.
 - c. Joist Depth: Plus 0, minus 1/8 inch.
9. Marking: Mark each piece with depth, joist spacing, and allowable span for joist spacing.
10. Provide bearing stiffeners if required by span rating or joist hanger manufacturer.
- B. Wood-Based Components:
- 1. Wood fabricated from old growth timber is not permitted.
- C. Joist Bridging: Type, size and spacing recommended by joist manufacturer, and as indicated on Drawings.
- D. Rim Boards: As designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with applicable research/evaluation report.
- E. Wood Blocking, Plates, and Miscellaneous Framing: As specified in Section 06 10 00.
- 1. Also provide framing anchors and fasteners as required and recommended by joist manufacturer, as applicable.
- F. Fasteners: Electrogalvanized steel, type to suit application.

2.03 WOOD TREATMENT

- A. Factory-Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports and openings are ready to receive joists.
- B. Verify that field measurements are as indicated on shop drawings.

3.02 PREPARATION

- A. Coordinate placement of bearing items.
- B. Coordination and Scheduling:
 - 1. Coordinate and sequence joist installation and details with Work specified in other Sections.
 - 2. Ensure proper interface of joists with adjoining components, to minimize cutting and penetration of joists
 - 3. Limit erected joists to the shortest possible exposure to the elements before closing-in of building envelope.

3.03 ERECTION

- A. Erect and secure joists as indicated on Drawings, the reviewed shop drawings.
- B. Install joists in accordance with manufacturer's instructions and recommendations.

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- C. Set structural members true to line, level and plumb, in correct position.
- D. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.
- E. Do not field cut or alter structural members without approval of Architect.
- F. Install permanent bridging and bracing.
 - 1. Provide erection bracing in addition to specified bridging to keep joists straight and plumb and to assure adequate lateral support until sheathing material has been applied.
 - 2. Install headers and supports to frame openings required.
- G. Frame openings between joists with lumber in accordance with Section 06 10 00 and as indicated on Drawings.
- H. Blocking and Stiffeners: Install blocking and stiffeners as required and shown for lateral support of members, to provide nailing surface for sheathing and finish materials and to fire-block cavities in accordance with Code.
- I. Coordinate installation of sheathing/decking with work of this section.
- J. Construction Loads: Do not permit temporary construction loads which cause member stresses beyond design limits.

3.04 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coat of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.05 TOLERANCES

- A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION

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**SECTION 06 18 00
GLUED-LAMINATED CONSTRUCTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glue laminated wood beams and purlins.
- B. Preservative treatment of wood.
- C. Steel hardware and attachment brackets.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. AITC 108 - Standard For Heavy Timber Construction.
- B. AITC 111 - Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection.
- C. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species.
- D. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber.
- E. ANSI 117 - Standard Specification for Structural Glued Laminated Timber of Softwood Species.
- F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- I. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- J. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric).
- 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 D3737 - Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam).
- N. 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.
- O. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products.

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- P. AWWA U1 - Use Category System: User Specification for Treated Wood.
- Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- S. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber.
- T. SPIB (GR) - Grading Rules.
- U. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17.
- V. WWPA G-5 - Western Lumber Grading Rules.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.
 - 1. Include data on lumber, adhesives, fabrication, and protection.
 - 2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treatment plant that treated materials comply with requirements.
 - 3. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated materials.
 - 4. Research/Evaluation Reports: For structural glued-laminated timber and connectors.
 - 5. Certifications:
 - a. Submit an AITC inspection certificate, signed by a Division of the State Architect approved fabricator, stating that the glue laminated wood members were produced in accordance with AITC A190.1.
 - b. Submit certification by a DSA approved treating plant that required treatments comply with specified standards.
- C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings .
 - 1. Submit design calculations signed and sealed by design engineer.
 - a. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Show layout of structural glued-laminated timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required work.
 - 3. Include large-scale details of connections, connectors, and other accessories.
- D. Manufacturer's Qualification Statement.
- E. 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.

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1.05 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.
 - 1. Produce factory-glued structural units by an AITC - or APA-licensed firm approved by DSA and qualified to apply the AITC "Quality Inspected" mark..
- B. Erector Qualifications: Company specializing in erection of products of the type specified with five years documented experience, and approved by manufacturer.
- C. 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. General: Comply with provisions in AITC 111, "Recommended Practice for Protection of Structural Glued Laminated Timber during Transit, Storage, and Erection."
- B. Protect members to AITC requirements for individually wrapped.
 - 1. Individually wrap members that are to be exposed in the final installation using plastic-coated paper covering with water-resistant seams. Bundle wrap all other members.
- C. Leave individual wrapping in place until finishing occurs.
 - 1. Open end of wrapping and loosen at job site to facilitate air circulation.
- D. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Conform to ASCE 7 code for loads, seismic zoning, and other load criteria.
- B. Except as modified by the requirements specified herein or as indicated, provide glue laminated wood meeting the requirements of the California Building Code (CBC) Title 24 Part 2, Chapter 23 with additional requirements for Division of the State Architect, including maximum moisture content allowable at time of fabrication.

2.02 MANUFACTURERS

- A. Glued-Laminated Structural Units:
 - 1. Basis of Design and DSA Approval: RedBuilt LLC: www.redbuilt.com, or approved equal.
 - 2. American Laminators; DSA inspected: www.americanlaminators.com.
 - 3. Boise Cascade Company; ICC ESR VAR-1017 : www.bc.com
 - 4. Western Wood Structures, Inc: www.westernwoodstructures.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

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2.03 GLUED-LAMINATED UNITS

- A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Industrial grade.
 - 1. Appearance Grade: As indicated above unless indicated otherwise on the Drawings, complying with AITC 110.
 - a. Use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.
 - b. Exposed and Partially Exposed Members: Architectural appearance grade.
 - c. Other Members: May have an Industrial appearance grade.
 - 2. Verify dimensions and site conditions prior to fabrication.
 - 3. Cut and fit members accurately to length to achieve tight joint fit.
 - 4. Fabricate member with camber built in.
 - 5. Do not splice or join members in locations other than those indicated without permission.
 - 6. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
 - 7. Welding: Perform welding in accordance with AWS D1.1/D1.1M.
 - 8. After end trimming, seal with penetrating sealer in accordance with AITC requirements.
- B. Performance Criteria:
 - 1. Comply with applicable code for loads, seismic zoning, and other load criteria.
 - 2. Design and laminate members in accordance with ANSI 117, or determined according to ASTM D3737 and acceptable to authorities having jurisdiction (Division of the State Architect).
 - 3. Seismic Performance: Provide structural glued-laminated timber, including connectors, capable of withstanding the effects of earthquake motions determined according to ASCE 7.
 - a. Seismic Design Criteria: See Drawings.

2.04 MATERIALS

- A. General: Provide structural glued-laminated timber that complies with AITC 117 manufacturing or research/evaluation reports acceptable to authorities having jurisdiction.
 - 1. Provide structural glued-laminated timber made from a single species.
- B. Lumber: Softwood lumber conforming to WCLB grading rules with 12 percent maximum moisture content before fabrication.
 - 1. Species and Grades for Structural Glued-Laminated Timber: Provide structural glued-laminated timber made from species and grades as indicated on Drawings.
- C. Lumber: Softwood lumber complying with RIS (GR) grading rules with 12 percent maximum moisture content before fabrication. As indicated on Structural Drawings.
 - 1. Lumber: Softwood lumber complying with RIS (GR) grading rules with 12 percent maximum moisture content before fabrication. As indicated on Structural Drawings

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2. Laminating Combinations: Provide laminating combinations meeting the requirements of ANSI/AITC A190.1 and provide the above allowable design values based on dry condition of service.
 3. Lumber fabricated from old growth timber is not permitted.
- D. Steel Connections and Brackets: ASTM A36/A36M weldable quality, galvanize per ASTM A123/A123M.
1. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
 2. Finish: Where "Wet Use" work is indicated, finish fabricated assemblies with hot dip zinc coating, ASTM A153/A153M, including bolts and other fasteners per CBC Title 24, Part 2, Sec. 2304.10.1.1.
- E. Anchor Bolts: ASTM F3125/F3125M, Type 1 heavy hex high strength bolts and ASTM A563 (ASTM A563M) nuts; hot-dip galvanized to meet requirements of ASTM A153/A153M, matching washers.
- F. Laminating Adhesive: AITC A190.1.
1. Use adhesive that contains no added urea-formaldehyde resins.
- G. Wood Sealer:
1. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.
 - a. After fabrication and sanding of each unit, and end coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.
 2. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
 - a. Immediately after end cutting each member to final length, and after wood treatment, apply a saturation coat of end sealer to ends and other cross cut surfaces, keeping surfaces "flood coated" for not less than 10 minutes.

2.05 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. Preservative Pressure Treatment: Where exposed to weather.
1. Manufacturers:
 - a. Lonza Group: www.wolmanizedwood.com/#sle.
 - b. Osmose Utilities Services, Inc: www.osmose.com/#sle.
 - c. Viance, LLC: www.treatedwood.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Preservative Pressure Treatment of Glued-Laminated Structural Units: AWPA U1, Use Category UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu

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ft retention.

- a. Kiln dry lumber after treatment and before lamination to maximum moisture content of 19 percent.
 3. Marking: Marked each piece with stamp of an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- C. Surface-Applied Wood Preservative:
1. Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.
 2. After dressing and fabricating members, apply a field-treatment preservative to comply with AWWA M4 to surfaces cut to a depth of more than 1/16 inch.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. Shop treat wood materials in accordance with manufacturer's instructions.

2.06 FABRICATION

- A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.
1. Moisture Content: Control moisture content at time of gluing and fabrication in accordance with AITC A190.1.
- B. End joints may be either a plane scarf having a slope not steeper than 1:10 or an approved finger joint.
1. Unless specifically approved by the Division of the State Architect (DSA), there shall be a minimum of 60 test specimens provided to qualify an end joint.
 2. All portions of end joints in adjacent laminations shall be separated in accordance with AITC A190.1 and ASTM D3737.
 3. The areas requiring 6 inch spacing shall be shown on the approved Shop Drawings.
 4. Joints in adjacent laminations of members with vertically oriented glue lines shall be separated as required for bending members.
 5. There shall be no knots or other defects within 6 inches of finger joints in areas where a 6 inch separation of joints in adjacent laminations is specified or within 2 knot diameters elsewhere.
- C. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.
1. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- D. Welding: Perform welding in accordance with AWS D1.1/D1.1M.
- E. Verify dimensions and site conditions prior to fabrication.
- F. Cut and fit members accurately to length to achieve tight joint fit.
- G. Fabricate member with camber built in.

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1. Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/480 of span.
- H. Do not splice or join members in locations other than those indicated without permission.
- I. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
- J. After end trimming, seal with penetrating sealer in accordance with AITC requirements.
 1. End-Cut Sealing: Immediately after end-cutting each member to final length and after preservative treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood-coated for not less than 10 minutes.
 2. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for preservative-treated wood where treatment included a water repellent.
- K. Field Finishing of Members: Specified in Section 09 91 13 and 09 91 23.
- L. Factory Finishing:
 1. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.
 - a. Color: As selected by Architect from manufacturer's full and custom range..
 2. Clear Finish: Manufacturer's standard, two-coat, clear conversion varnish finish; oven dried and resistant to mildew and fungus.
- M. Factory Applied Protection:
 1. Individually wrap each Architectural grade member for shipment with heavy water resistant paper in accordance with AITC 111. Individually or bundle wrap Industrial grade members at manufacturer's option.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports are ready to receive units.
- B. Verify sufficient end bearing area.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coordinate placement of bearing items.
- B. Coordinate routing of pipes, ductwork and conduits to avoid penetrations through glue laminated structural units.

3.03 ERECTION

- A. Lift members using protective straps to prevent visible damage.
- B. Erect members as indicated and in accordance with AITC 108 and the approved Shop Drawings and instructions of the fabricator. Erect structural glued-laminated timber with uniform, close-fitting joints.

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1. Install structural glued-laminated timber to comply with Shop Drawings.
 2. Install timber connectors as indicated.
- C. Set structural members level and plumb, in correct positions or sloped where indicated.
- D. Provide temporary bracing and anchorage to hold members in place until permanently secured.
- E. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.
1. If required by field conditions, not manufacturer error, fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
 - a. Predrill for fasteners using timber connectors as templates.
 - b. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - c. Coat crosscuts with end sealer.
 - d. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
 - 1) Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - 2) Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
 2. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
 - a. Where preservative-treated members must be cut during erection, apply a field-treatment preservative (heavy brush coat of the same preservative treatment used during fabrication) to comply with AWPA M4 and applicable air quality regulations for VOC.
 - 1) Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - 2) Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- F. Swab and seal the interior wood surfaces of field drilled holes in members with primer.
- G. Field Finishing: Specified in Section 09 91 13 and 09 91 23.

3.04 TOLERANCES

- A. Framing Members: 1/2 inch maximum from true position.

3.05 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

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3.06 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose including protection from weather, sunlight, soiling, and damage from work of other trades.
 - 1. Coordinate wrapping removal with finishing work specified in Division 9. Retain wrapping where it can serve as a painting shield.

END OF SECTION

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**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 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 08 14 16 - Flush Wood Doors.
- D. Section 06 41 00 - Architectural Wood Casework: Cabinet hardware.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood.
- C. BHMA A156.9 - Cabinet Hardware.
- D. NEMA LD 3 - High-Pressure Decorative Laminates.
- E. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork.

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.

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- 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.
 - 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.

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- 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. Primer: Alkyd primer sealer.
- E. Wood Filler: Oil base, tinted to match surface finish color.

2.07 HARDWARE

- A. Hardware: Comply with BHMA A156.9.

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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. 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 plastic 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 13, 09 91 23, and 09 93 00.
- 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

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**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 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 06 20 00 - Finish Carpentry: Wood trim unrelated to casework.
- D. Section 12 36 00 - Countertops.

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. BHMA A156.9 - Cabinet Hardware.
- D. NEMA LD 3 - High-Pressure Decorative Laminates.

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 information as 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.

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- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Maintenance Materials: Furnish the following for District's use in maintenance of project:
 - 1. Spare Parts: One of each kind of lock.
 - 2. 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 (MCP) 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.

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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 CONDITIONS

- 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. Wall hung cabinets and floor supported cabinets over 5 feet high shall be braced and anchored in accordance with the California Building Code (CBC) Title 24 Part 2, Table 1607A.1.
 - 1. Comply with OHSPD Pre-Approval OPM-0092.
- B. Requirements for Persons with Disabilities: Provide products meeting requirements of California Code of Regulations (CCR), Title 24, Part 2, Chapter 11B and ADA Accessibility Guidelines for Buildings and Facilities, latest amendment.
 - 1. Operable parts for all accessible casework shall comply with CBC Section 11B-309 Operable Parts.
 - 2. Pull hardware shall be U-shaped wire pulls or equally accessible at all accessible casework; CBC 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.

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- 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.
 - f. 600 Series: Library 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.

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- a. Basis of Design Material: Combination Core, PureBond Classic Core, www.columbiaforestproducts.com, or approved equal.

2.04 LAMINATE MATERIALS

- A. Manufacturers: PL-1, PL-2
 - 1. Arborite: www.arborite.com/#sle.
 - 2. Formica Corporation: www.formica.com/#sle.
 - 3. Lamin-Art: www.laminart.com.
 - 4. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 5. Wilsonart LLC: www.wilsonart.com/#sle.
- 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. Urea Formaldehyde adhesives shall not be used.
 - 2. Contact cement shall have a VOC content of less than 80 g/l.
- B. Fasteners: Size and type to suit application.
- C. 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.

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D. 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 5mm hole diameter.: Knap & Vogt Manufacturing Company; Product No. 339: www.knapeandvogt.com.
- C. 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
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
 - 1. Provide locks on 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.
 - 2. Locks for doors and drawers shall be keyed alike for each room and master keyed.
 - 3. Metal Strike Plates: Provide cabinet door and drawer locks with metal strike plates to protect against particle board rip out.
 - 4. 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.
 - 5. Locks shall be easily rekeyable pin tumbler with working top slide and retainer staple.
 - 6. Cabinet Locks:
 - a. Olympus Lock; Product 500DR: www.olympus-lock.com.
 - b. Corbin Cabinet Lock; Product 0737 Drawer Lock: www.cclsecurity.com.
 - 7. Drawer Locks: Finish US 26D
 - a. Olympus Lock; Product 600DW: www.olympus-lock.com.
 - b. Corbin Cabinet Lock; Product 0738 Drawer Lock: www.cclsecurity.com.

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E. Cabinet Catches and Latches:

1. Type: Roller catch and Magnetic catch.
2. Catches for Doors Without Locks: Magnetic with aluminum case.
 - a. Amerock; Product No. 145: www.amerock.com.
 - b. The Engineered Products Co.; Product EP591: www.epcohardwarecurity.com.
 - c. Stanley Architectural Hardware; Product CD46.
3. Catches for Inactive Leaf of Pairs of Doors With Locks: Elbow catch.
 - a. Amerock; Product E.Z. Flex No. 3675-2G: www.amerock.com.
 - b. The Engineered Products Co.; Product No. 1016: www.epcohardwarecurity.com.
 - c. Ives; Product 2-A92: www.iveshinges.com.

F. 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: Bottom mounted.
4. Stops: Positive type.
5. Features: Provide self closing/stay closed type.
6. Manufacturers:
 - a. Accuride International, Inc; Light-Duty Drawer Slides: www accuride.com/#sle.
 - b. Accuride International, Inc; Heavy-Duty Drawer Slides: www accuride.com/#sle.
 - c. Blum, Inc; MOVENTO: www.blum.com/#sle.
 - d. Grant Hardware Company, Division of Hettich International: www.hettichamerica.com.
 - e. Hettich America, LP: www.hettich.com/#sle.
 - f. Hafele America Co.
 - g. Knappe & Vogt Manufacturing Company; Light-Duty Drawer Slides: www.knapeandvogt.com/#sle.
 - h. Knappe & Vogt Manufacturing Company; Medium-Duty Drawer Slides: www.knapeandvogt.com/#sle.
 - i. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knapeandvogt.com/#sle.

G. Hinges: Butt self-closing type, BHMA No. A156.9 level, Grade 1, steel with polished finish.

1. Manufacturers:

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- 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.

2.08 SITE FINISHING MATERIALS

- A. Stain, Shellac, 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. 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.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Install work in accordance with AWMAC/WI (NAAWS) requirements for grade indicated.
 - 1. Install in accordance and comply with WI Certified Seismic Installation Program (CSIP).
 - a. Certified Seismic Casework Installation:
 - 1) All wood or metal frame wall construction shall be constructed with continuous in wall blocking of either 3x6 flat Douglas Fir, 16 ga. x 6 inch wide, or as indicated on the AHJ approved structural drawings, 50 KSI sheet metal provided in accordance with the location requirements included on the cabinet fabricator/installer’s shop drawings. Responsibility for blocking installation shall be that of the wall fabricator.
 - 2) All casework installation shall be certified by the Woodwork Institute in accordance with their Certified Seismic Installation Program (CSIP), including:
 - (a) A CSIP Certificate indicating that all of the casework installation fully meets the requirements of the NAAWS and CSIP.
 - 3) It is the responsibility of the installer to include within their bid, any and all costs for WI’s CSIP certification. Certification is a prerequisite for final acceptance. For further information, please visit www.woodworkinstitute.com
 - 2. Provide a WI Certified Compliance Certificate for installation as specified herein.
- 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.
 - 2. Base Cabinets: Set cabinets straight, plumb, and level. Adjust sub-tops within 1/16 inch of a single plane. Fasten each individual cabinet to floor at toe space, with fasteners spaced 12 inches on center. Bolt continuous cabinets together. Secure individual cabinets with not less than 2 fasteners into floor, where they do not adjoin other cabinets.
 - a. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
 - 3. Wall Cabinets: Securely fasten woodwork per (Project City) Standards (as adopted by WI) to solid supporting wall framing material, not plaster, lath, or gypsum board. Anchor, adjust, and align wall cabinets as specified for base cabinets.
 - a. Reinforcement of stud walls to support wall-mounted cabinets specified in appropriate section, but responsibility for accurate location and sizing of reinforcement shall be coordinated with applicable trade.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.

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- 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

<p>Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55</p>		<p>Architectural Wood Casework 06 41 00 - 10</p>
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**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 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.

1.03 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 District's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.04 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. Basis of Design Product: Panolam FRP as manufactured by Panolam Industries International, Inc., or approved equal.
- B. Fiberglass Reinforced Plastic Panels:
 - 1. Crane Composites, Inc: www.cranecomposites.com.

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2. Marlite: Standard FRP: www.marlite.com.
3. Nudo: www.nudo.com.
4. Panolam Industries International, Inc.; Panolam FRP: www.panolam.com
5. Parkland Performance; Plas-TEX PolyWall; 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: 0.09 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.

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- 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

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**SECTION 07 21 00
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Batt insulation and vapor retarder in exterior wall construction.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- C. Batt insulation for acoustic applications in interior walls.

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers: Separate vapor retarder materials.
- B. Section 07 54 00 - Thermoplastic Membrane Roofing: Insulation specified as part of the roofing membrane system.

1.03 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 E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.

1.04 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.

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1.05 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 in Wood Framed Walls: Batt insulation with no vapor retarder.
- B. Insulation in Wood Framed Ceiling Structure: Batt insulation with no vapor retarder.

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2.03 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 19.
 - b. Thickness: Each 5-1/2 inch.
 - 6. Underside of Roof:
 - a. Thermal Resistance: R-value of 30.
 - b. Thickness: 10-1/4 inch.
 - 7. Exposed Facing in Rooms and Enclosed Spaces: FSK (Foil-Scrim-Kraft), one side.
 - a. Class C per ASTM E84.
 - 8. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Knauf Insulation: www.knauf.com.
 - d. Owens Corning Corporation: 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.
 - b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
 - c. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

- A. Sheet Vapor Retarder: See Section 07 26 00.
- B. Wire Mesh: Galvanized steel, hexagonal wire mesh.
- C. Adhesive: Type recommended by insulation manufacturer for application.

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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 EXTERIOR WALLS

- A. Adhere 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 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.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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**SECTION 07 25 00
WEATHER BARRIERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- C. Section 07 92 00 - Joint Sealants: Sealing building expansion joints.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

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 D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- 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 D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- F. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments.

1.05 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.

1.06 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.

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- D. Manufacturer's Installation Instructions: Indicate preparation.
- E. Testing Agency Qualification Statement.

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.08 WARRANTY

- A. Extended Warranty:
 - 1. Provide written guarantee from waterproofing membrane manufacturer, and furnish joint written warranty to District from waterproofing applicator and Contractor, covering all membranes, and other elements essential to be watertight and will continue to be watertight for a period of at least five years following Acceptance of the Work.
 - 2. Waterproofing membrane manufacturer, and waterproofing applicator and Contractor shall, upon request by District, make all repairs, at no cost to District and without dollar limit, as necessary to correct all waterproofing membrane material or workmanship defects.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- 1. Use plastic sheet unless otherwise indicated.
- 2. Under Portland cement stucco, use two separate layers of building paper.
- 3. Under siding, use two separate layers of building paper.

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)

- A. Building Paper: Asphalt-saturated Kraft building paper complying with requirements of ICC-ES AC38 Grade D.
 - 1. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of five hours, when tested in accordance with AATCC Test Method 127.
 - 2. Manufacturers:
 - a. Fortifiber Corporation JUMBO-TEX secondary layer only, asphalt-saturated Kraft-Type paper complying with Federal Specification UUB 790a, Type 1, Grade D, Style 2.
- B. Plastic Sheet: Polymeric-based sheet complying with requirements of ICC-ES AC38 Grade D with 60-minute water-resistance; do not use polyethylene sheet.
 - 1. Manufacturers:
 - a. Certainteed, Inc.; CertaWrap Weather-Protection Membrane: www.certainteed.com.
 - b. DuPont Building Innovations; Tyvek Commercial Wrap D with FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: www.dupont.com.

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- c. Fiberweb, Inc.; Typar MetroWrap: www.typar.com.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- 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. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.
 - 2. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
 - 3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 5. Water Vapor Permeance: 0.067 perm, 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. Manufacturers:
 - a. Carlisle Coatings and Waterproofing, Inc.; CCW-705 TFW: www.carlisle-ccw.com.
 - b. CETCO ; Product Strong Seal SA; www.cetco.com.
 - c. Fortifiber Building Systems Group; FortiFlash: www.fortifiber.com/#sle.
 - d. Fortifiber Building Systems Group; FortiFlash Commercial: www.fortifiber.com/#sle.
 - e. GCP Applied Technologies; Perm-A-Barrier Detail Membrane: gcpat.com/en/solutions/products/perm-a-barrier-air-barrier-system.
 - f. InterWrap, Inc. Mission, BC Canada ; Product Titanium-PSU-30; www.interwrap.com.
 - g. Protecto Wrap; Jiffy Seal 140/60 Air/Vapor Barrier: www.protectowrap.com.
 - h. Soprema, Inc.; Product Lastobond Shield HT MU; www.soprema.us.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

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- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.
 - 1. Apply water-resistive barrier complying with:
 - a. Section 1402.1 of the CBC.
 - b. Section 1404.2 of the CBC.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
 - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
 - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
 - 4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
 - 5. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches below bottom of framing and seal to foundation with sealant.
 - 6. Install air barrier and vapor retarder underneath the jamb flashings.
 - 7. Install head flashings under weather barrier.
 - 8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
 - 9. Penetration Sealing: Seal all penetrations through paper from backside using non-staining sealant as specified in Section 07 90 05 - Joint Sealers.
- D. Self-Adhered Sheets:
 - 1. At sloped wall segments, all caps, parapets and horizontal projections, surfaces, all locations where products are secured through cement plaster and other locations where waterproof underlayment is indicated; install minimum one layer of self-adhesive sheet. Provide in addition to and integrated with weather barriers as indicated in this section.
 - 2. Penetration Flashing: Install self-adhering waterproof backing in weatherboard fashion following Plaster Institute recommendations.
 - 3. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
 - 4. Lap sheets shingle-fashion to shed water and seal laps air tight.
 - 5. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.

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6. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
 7. At wide joints, provide extra flexible membrane allowing joint movement.
- E. Openings and Penetrations in Exterior Weather Barriers: Comply with Drawing details. As a minimum provide the following:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 2. At openings to be 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 to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather 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 weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Water-Spray Test: Provide water spray quality test of installed weather barrier components in accordance with a modified 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 and 50 percent completion of this work.
 3. Testing: Water test the complete weather barrier after completion 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.
- 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 weather barriers until required inspections have been completed.
- E. Take digital photographs of each portion of the installation prior to covering up.

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3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

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SECTION 07 42 13.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior curtain wall system consisting of formed metal composite material (MCM) sheet, framing, secondary supports, and anchors to structure. MCP-1
- B. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers: Water-resistive barrier behind wall panel system.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
- E. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- J. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- K. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives.
- L. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
- M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

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- N. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- O. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
 - 1. Require attendance by the installer and relevant sub-contractors.
 - 2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
 - 3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
 - 4. Review procedures for protection of work and other construction.
 - 5. Review safety precautions.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
 - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
 - 2. Storage and handling requirements and recommendations.
 - 3. Fabrication instructions and recommendations.
 - 4. Specimen warranty for finish, as specified herein.
- C. 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.
 - 4. Specimen warranty for wall system, as specified herein.
- D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - 1. Indicate panel numbering system.
 - 2. Differentiate between shop and field fabrication.
 - 3. Indicate substrates and adjacent work with which the wall system must be coordinated.
 - 4. Include large-scale details of anchorages and connecting elements.

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- 5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
- 6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- E. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's standard range of available colors and patterns.
 - 1. Sealant Color: Color as selected by Architect.
- F. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch square, and representing actual product in color and texture.
- G. Certificate: Certify that the work results of this section meet or exceed specified requirements.
- H. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.
- I. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.
- J. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.
- K. Manufacturer's qualification statement.
- L. Installer's qualification statement.
- M. Maintenance Data: Care of finishes and warranty requirements.
- N. Executed Warranty: Submit warranty and ensure that forms have been completed in District's name and registered with manufacturer.
- O. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in District's name and registered with installer.

1.06 QUALITY ASSURANCE

- A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in California.
- C. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
 - 1. With not less than three years of documented experience.
 - 2. Approved by MCM sheet manufacturer.
 - 3. Submit contact names and phone numbers for at least three references connected with successful past projects.
- D. Installer Qualifications: Company specializing in performing work of type specified in this section.
 - 1. With minimum three years of documented experience.

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- 2. Approved by wall panel system manufacturer.
 - 3. Submit contact names and phone numbers for at least three references connected with successful past projects.
- E. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
- 1. Protect finishes by applying heavy-duty removable plastic film during production.
 - 2. Package for protection against transportation damage.
 - 3. Provide markings to identify components consistently with drawings.
 - 4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- 1. Store in well-ventilated space out of direct sunlight.
 - 2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
 - 3. Store at a slope to ensure positive drainage of accumulated water.
 - 4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
 - 5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.08 FIELD CONDITIONS

- A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of wall panels. Complete forms in District's name and register with warrantor.
- 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 District's name and register with warrantor.
- D. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions;

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design MCP-1 Product: Envelope Reserve RV, Series F as manufactured by Citadel, or approved equal.
- B. Metal Composite Material (MCM) Sheet Manufacturers:
 - 1. ALUCOBOND USA; ALUCOBOND PLUS: www.alucobondusa.com/#sle.
 - a. ICC ESR-1114
 - b. ICC ESR-1185
 - 2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core): www.alpolic-america.com/#sle.
 - a. ICC ESR-2653, FR core.
 - b. ICC ESR-3704, PE core.
 - 3. Citadel Architectural Products, Inc; Envelope 2000: www.citadelap.com/#sle.
 - a. ICC ESR-1015.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Wall Panel System Manufacturers:
 - 1. Basis of Design : 3A Composites USA; Rout and Return Dry-Seal: www.alucobondusa.com, or approved equal.
 - 2. Citadel Architectural Products, Inc; Envelope 2000 Rout and Return (RR) System: www.citadelap.com/#sle.
 - 3. Firestone Metal Products, LLC: www.unaclad.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WALL PANEL SYSTEM

- A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
 - 1. Provide structural design by or under direct supervision of a Structural Engineer licensed in California.
 - 2. Provide panel jointing and weatherseal using a "wet", sealant-sealed system.
 - 3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

- A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

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1. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
 2. Design Wind Pressure: As specified in CBC/ASCE 7.
 3. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
 4. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.
- B. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.27 psf minimum, after 15 minutes.
1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
 2. Design to drain leakage and condensation to the exterior face of the wall.

2.04 MATERIALS

- A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
1. Overall Sheet Thickness: 0.139 inch, minimum.
 - a. Unless indicated otherwise on Drawings.
 2. Face Sheet Thickness: 0.024 inches, minimum.
 3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
 4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
 5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 6. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.
- B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.
 2. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

2.05 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated aluminum surfaces having minimum total

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dry film thickness (DFT) of 0.9 mils, 0.0009 inch; color and gloss as selected by Architect from manufacturer's standard line.

- B. Color/Texture: As selected by Architect from manufacturer's standard range.

2.06 ACCESSORIES

- A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.
- B. Anchors, Clips, and Accessories: Use one of the following:
 - 1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
 - 2. Steel complying with ASTM A36/A36M and hot-dipped zinc coating to ASTM A153/A153M.
 - 3. Steel complying with ASTM A36/A36M and hot-dipped galvanized coating to ASTM A123/A123M, Coating Grade 10.
- C. Fasteners:
 - 1. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
 - 2. Bolts: Stainless steel.
 - 3. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.
- D. Joint Sealer: Provide color as selected by Architect silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.
- E. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine dimensions, tolerances, and interfaces with other work.
 - 1. Verify that water-resistive barrier system is properly installed; see Section 07 25 00 for requirements.
- B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
 - 1. Inspect framing that will support composite wall panel system to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to composite wall panel system manufacturer.
 - a. Maximum deviations acceptable to composite wall panel system manufacturer:
 - 1) 1/4 inch in 20 feet vertically or horizontally from face plane of framing.
 - 2) 1/2 inch maximum deviation from flat substrate on any building elevation.
 - 3) 1/8 inch in 5 feet.

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- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
 - 1. Correct out-of-tolerance work and other deficient conditions prior to proceeding with composite wall panel system installation.
- D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
- C. Accessories: Install all components required for a complete assembly, including flashings, gutters, trim, moldings, closure strips, preformed crickets, closures, and similar accessory items.
- D. Install underlayment on horizontal surface before installing metal panels. See Section 07 25 00 - Weather Barriers. 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.
- E. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- F. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- G. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.
- H. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- I. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
- J. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
 - 1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
 - 2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
 - 3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.

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- 4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.
- K. Replace damaged products.
 - 1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
 - 2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.
- C. Site Visits: Schedule two site visits during execution of installation.

3.05 CLEANING

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

- A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

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**SECTION 07 54 00
THERMOPLASTIC MEMBRANE ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Cover boards.
- D. Flashings.
- E. Roofing cant strips, stack boots, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings and reglets.
- B. Section 07 72 00 - Roof Accessories: Roof-mounted units; prefabricated curbs.
- C. Division 22 - Plumbing: Roof drains, sumps, and hoppers.
- D. Division 26 - Electrical: Conduit penetrating roofing membrane.

1.03 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- C. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.
- D. FM (AG) - FM Approval Guide.
- E. FM DS 1-28 - Wind Design.
- F. NRCA (RM) - The NRCA Roofing Manual.
- G. NRCA (WM) - The NRCA Waterproofing Manual.
- H. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.
 - 2. Notification: Two weeks prior to pre-application conference, inform District and Architect of scheduled roofing beginning and completion dates, such that District may arrange for independent inspection of roofing Work, and presence of independent testing and inspection agency at pre-application conference.

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3. Attendance: Require attendance by Contractor's superintendent and other supervisory and quality control personnel having responsibility for roofing, supervisory personnel of roofing applicator and, if required for warranty provisions, representative of roofing products manufacturer.
 - a. DSA, Architect's insurer, independent testing and inspection agency and Architect, if authorized by District, will attend.
 - b. Require attendance of installers of each component of related Work, including deck or substrate construction, rigid insulation, metal flashing, rooftop equipment, penetrations of roof deck, and other Work integral with or adjacent to roofing may attend.
 - c. If required, attendance shall include authorities having jurisdiction. Contractor shall verify requirement with authorities having jurisdiction and arrange for attendance.
 - d. Agenda:
 - 1) Meeting purpose is to review Drawings and Specifications for suitability for application of roofing system.
 - 2) Review application procedures and coordination required with related Work. Discuss changes and deviations from Drawings and Specifications, if any, recommended or required.
 - 3) Walk roof areas to review and discuss substrate preparation including repair of unacceptable surfaces, roof drainage, penetrations, equipment curbs, and work performed by other trades, which require coordination with roofing system.
 - 4) Review contract document requirements and submittals for roofing system, including roofing schedule, inspection and testing, and environmental conditions. Identify which governing regulations or insurance requirements will affect roofing system installation.
 - 5) Discuss anticipated weather, as well as procedures for responding to unacceptable weather, including using temporary roofing. Temporary roofing, if necessary, will be added to scope of the Work by contract modification (change order or construction change directive), with acceptable adjustment in Contract Time and Contract Sum.
 - 6) Document discussions in writing, including actions required, and distribute copy of report to each meeting participant.
 - 7) Attendance by DSA, Architect and independent testing and inspection agency shall not relieve Contractor of sole responsibility for means, methods, techniques and sequence of construction, in accordance with provisions of the Conditions of the Contract.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.

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- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Specimen Warranty: For approval.
- J. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.
 - 2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.06 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 this section with at least three years of documented experience.
- C. Industry Standards:
 - 1. Conform to manufacturer's product data and application instructions.
 - 2. Perform work in accordance with NRCA (RM) and NRCA (WM) and and Western States Roofing Contractors Association (WSRCA).
 - a. Maintain one copy on site.
- D. Testing and Inspection:
 - 1. District's independent inspection and testing agency will perform inspections and tests of roofing work.
 - 2. Costs of this service will be paid for by District.
 - 3. Contractor shall cooperate with independent testing and inspection agency.
 - 4. Refer to general requirements specified in Section 01 40 00 - Quality Requirements and 01 45 33 - Code-Required Special Inspections.
- E. Private label and third-party-manufactured membranes are not permitted.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.
- C. Store materials in weather protected environment, clear of ground and moisture.

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- D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- E. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 95 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.
 - 1. Provide temporary roof membrane if necessary to protect portions of the Work before final roofing can be installed.
 - a. Record by way of change order the District's agreement to proceed with temporary roofing, along with additional costs and other changes (if any) to Contract Documents.
 - b. Remove temporary roofing before starting installation of final roofing system.
- F. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage.
 - 1. Provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.
 - 2. Provide a substantial protection layer consisting of plywood over felt or plywood over insulation board for all new and existing roof areas that receive rooftop traffic during construction.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years.
 - a. Provide a written guarantee signed by the manufacturer's authorized official, agreeing to correct failures in product and installation, with no dollar limit on such corrections, for the noted warranty term from date established in Notice of Completion.
 - 2. Include insulation and flashing as part of the roofing system and all other manufacturer supplied system components to be used as part of the roofing assembly..
 - 3. For repair and replacement include costs of both material and labor in warranty.
 - 4. Exceptions are not Permitted:

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- a. Damage due to roof traffic.
 - b. Damage due to wind speed up to 60 mph.
 - c. Damage due to ponding water; assign no time limit for any such ponding water during the warranty period.
 - d. Roof system maintenance.
- C. Applicator/Roofing Contractor Warranty:
- 1. Applicator to supply the District with a separate five-year workmanship warranty.
 - 2. In the event any work related to roofing, flashing, or associated metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the District.
 - 3. The Applicator's warranty obligation shall run directly to the District, and a copy shall be sent to the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
- 1. Basis of Design Product: G-410 ES as manufactured by Sika Sarnafil, a Division of Sika Corporation, or approved equal.
 - 2. Carlisle Roofing Systems, Inc; Sure-Flex PVC: www.carlisle-syntec.com/#sle.
 - 3. Johns Manville; JM PVC Fleece Backed ES (Energy Saving), 80 mil, SP8PA: www.jm.com/#sle.
 - 4. Sika Corporation Roofing; Sarnafil PVC: usa.sika.com/sarnafil/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation:
- 1. Insulation manufacturer as part of the tested and warrantable roofing system membrane assembly.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

2.03 ROOFING - UNBALLASTED APPLICATIONS

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered.
- B. Roof Assembly: (from the top down)

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1. Typical assembly:
 - a. Roofing Membrane
 - b. Cover Board - Glass mat gypsum panel.
 - c. Tapered Insulation layers for crickets.
 - d. Deck Sheathing.
 - e. Roof deck.
- C. Roofing Assembly Requirements:
 1. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.
 2. Factory Mutual Classification: Class 1 and windstorm resistance of 1-90, in accordance with FM DS 1-28.
- D. Acceptable Insulation Types - Tapered Application: Any of types specified.
 1. Tapered polyisocyanurate board.

2.04 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

- A. Membrane Roofing Materials:
 1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type II, sheet contains reinforcing fibers or reinforcing fabrics.
 - a. Thickness: 80 mil, 0.080 inch, minimum.
 - b. Backing: 9 oz. Feltback fabricated as part of the membrane.
 2. Sheet Width:
 - a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.
 3. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
 4. Thermal Emissivity: 0.80, minimum, initial, and 0.79, minimum, 3-year, certified by Cool Roof Rating Council.
 5. Color: White, integral.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashing Material: Same material as membrane.

2.05 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 1. Thickness: 5/8 inch, Type X, fire-resistant.
 - a. Application: Over parapet wall studs.
 2. Thickness: 1/4 inch, fire-resistant.
 3. Products:

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- a. Basis of Design: Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com/#sle.
- b. USG; USG Securock® Brand UltraLight Glass-Mat Roof Board: www.usg.com.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type II:
 - 1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
 - 2) Compressive Strength: Classes 1-2-3, Grade 3, 25 psi (172 kPa), minimum.
 - 2. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
 - 3. Board Edges: Square.
 - 4. Products:
 - a. Basis of Design Product: Sarnatherm (ACFoam®-II) as manufactured by Atlas Roofing, or approved equal.
 - b. DuPont de Nemours, Inc: building.dupont.com/#sle.
 - c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
 - d. Rmax Inc.; ECOMAXci: www.rmax.com.
 - e. [_____].
 - f. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ACCESSORIES

- A. Clad Metal Flashing:
 - 1. Description: Membrane-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles.
 - 2. Materials: 24 gauge, G90 galvanized metal sheet with a 20 mil unsupported roofing membrane laminated on one side.
 - 3. Color: Clad metal to match roofing membrane.
 - 4. Product: Sarnaclad manufactured by Sarnafil.
- B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.
- D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

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1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- E. Membrane Adhesive: As recommended by membrane manufacturer.
- F. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- G. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- H. Insulation Adhesive: As recommended by insulation manufacturer.
- I. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.
- J. Sealants: As recommended by membrane manufacturer.
- K. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 1. Composition: Roofing membrane manufacturer's standard.
 2. Size: Manufacturer's standard size.
 3. Surface Color: White or Yellow.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - WOOD DECK

- A. Composition:
 1. FM Approved Wood Deck: Minimum 2 inch thick lumber or 3/4 inch thick treated plywood.
 - a. Conform deck to FM requirements for Class 1 fire-retardant and rot-resistant wood.
 - b. Install deck according to FM and local code requirements.
 2. Non-FM Approved Wood Deck: Minimum 1-1/2 inch thick lumber or 15/32 inch thick plywood.
 - a. Install deck according to local code requirements.
 - b. Contact Manufacturer's Technical support for fastening patterns and methods.
- B. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

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3.03 INSTALLATION, GENERAL

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.04 INSTALLATION - INSULATION, UNDER MEMBRANE

- A. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
- B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.
- G. Do not install more insulation than can be covered with membrane in same day.

3.05 INSTALLATION - MEMBRANE

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate of 0.69 gallons per square foot. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
 - 3. Secure flashing to nailing strips at 4 inches on center.

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- 4. Insert flashing into reglets and secure.
- F. At gravel stops, extend membrane under gravel stop and to the outside face of the wall.
- G. Around roof penetrations, seal flanges and flashings with flexible flashing.
- H. Coordinate installation of roof drains and sumps and related flashings.

3.06 BUILDING IDENTIFICATION

- A. Face the numbering/lettering toward the street. Locate as close to center of roof as possible.
- B. Numbers/Letters Character Shape: Block type.
 - 1. Character height: 72 inches, minimum.
 - 2. Stroke Width: 6 inches, minimum.
- C. Provide the same roofing product specified to stencil building numbers and building description at each roof.
- D. Coating Thickness: Minimum 25 mils dry. Color: Black.
- E. Color: Black.

3.07 TEMPORARY CUT OFF

- A. Install flashings concurrently with the roof membrane in order to maintain a watertight condition as the work progresses.
 - 1. Construct all temporary waterstops to provide a 100% watertight seal.
 - 2. Make staggered insulation joints even by installing partial panels of insulation.
 - 3. Carry new membrane into the waterstop.
 - 4. Seal waterstop to the deck and/or substrate so that water will not be allowed to travel under the new or previous roofing.
 - 5. Seal the edge of the membrane in a continuous heavy application of sealant as described in Part 2 above.
 - 6. When work resumes, cut out the contaminated membrane.
 - a. Remove all sealant, contaminated membrane, insulation fillers, etc.; from the work area and properly disposed of off site.
 - b. Do not use these materials in the new work.
- B. If inclement weather occurs while a temporary waterstop is in place, provide the labor necessary to monitor the situation to maintain a watertight condition.
- C. If any water is allowed to enter under the newly-completed roofing, remove and replace the affected area at Applicator's expense

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. District will provide testing services, and Contractor to provide temporary construction and materials for testing.
- C. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

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1. Provide regular daily written reports to the Contractor and Architect for every day of roofing installation work.
 2. Provide to Architect a written on-site approval by the roofing system manufacturer and sign-off on pre-roofing deck, insulation installation, membrane installation, flashing details and completed assembly.
 3. Provide to Architect a Project Closeout Report by the roofing system manufacturer upon delivery of the project warranty. This report shall include the following sections:
 - a. Project Specifications.
 - b. Project Summary.
 - c. Progress reports as a result of roof inspections.
 - d. Job progress photos.
 - e. Warranty document with Maintenance Manual describing maintenance and emergency repair.
- D. Roofing Inspection and Testing Services by Independent Agency: District's independent agency will provide inspection and testing services during application of roofing system.
1. Unless otherwise directed, inspection, including test cuts and evaluation procedures, will be performed in accordance with Chapter V, "Quality Control," of The NRCA Low-Slope Roofing Manual.
 2. Independent agency will provide reports of inspections and tests to DSA and Architect. Copies of reports will also be provided to Contractor.
 3. Water Test: Conduct simulated rain storm test by indirect spray of water for 15 minutes over entire roof surface. Check area below roofing for leaks and check top surface for standing water.
 - a. Record test and inspection by video tape or digital recording.
 4. Remedial Work: Correct all defects and irregularities reported from inspections and tests, at no change in Contract Sum or Contract Time.

3.09 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.10 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

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**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. SM-1, SM-2
- B. Sealants for joints within sheet metal fabrications.

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. Section 07 54 00 - Thermoplastic Membrane Roofing: Roofing system and membrane clad flashing.
- 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 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- 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 C920 - Standard Specification for Elastomeric Joint Sealants.
- D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- F. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
- G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- H. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- I. 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.

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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. Membrane Clad Flashing: Refer to Section 07 54 00 - Thermoplastic Membrane Roofing.
- C. SM-1, SM-2, Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
 - 1. Color: As indicated on drawings.

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.

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- 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 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, or approved 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/cm³.
 - 2) HDPE, Tensile Strength at Yield, ASTM D638: 3,100 psi.
 - 3) LDPE, Specific Gravity, ASTM D792: 0.917 g/cm³.
 - 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/cm³.
 - 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/cm³.

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- c. Tensile Strength, ASTM D412: 1,300 psi.

2.04 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.

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. Parapet Coping/Cap: SMACNA Architectural Sheet Metal Manual, Detail 3-1, 3-3(18 Butt Seam w/ backing plates).
 - 3. Roof - Penetration Flashing: SMACNA Architectural Sheet Metal Manual, Detail 4-13 through 4-16.

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- 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. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:
 - 1. Secure receiver at perimeter of wall opening with adhesives or fasteners.
 - 2. Place flashing into receiver channel.
 - 3. Secure flashing with receiver clip.
- G. Seal metal joints watertight.
- H. Scuppers and Overflows Installation:
 - 1. Mechanically fasten and solder joints.
 - 2. Fold outside edges under 1/2 inch on all sides.

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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.
- I. 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.

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- 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.

END OF SECTION

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**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.

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. SCAQMD 1168 - Adhesive and Sealant Applications.
- M. SWRI (VAL) - SWR Institute Validated Products Directory.

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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. 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.

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.

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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. 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 District.
 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.
- F. 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.

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.

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- 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.
 2. Bostik Inc: www.bostik-us.com.
 3. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 4. Fortifiber Building Systems Group: www.fortifiber.com/sle.
 5. Hilti, Inc: www.us.hilti.com/#sle.
 6. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
 7. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
 8. Pecora Corporation: www.pecora.com.
 9. QUIKRETE Companies: www.quikrete.com/#sle.
 10. Sherwin-Williams Company: www.sherwin-williams.com.
 11. Sika Corporation: www.usa-sika.com.
 12. Specified Technologies Inc: www.stifirestop.com/#sle.
 13. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 14. W.R. Meadows, Inc: 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.
 2. Bostik Inc: www.bostik-us.com.
 3. Dayton Superior Corporation: www.daytonsuperior.com.
 4. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 5. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
 6. Pecora Corporation: www.pecora.com.
 7. QUIKRETE Companies: www.quikrete.com/#sle.
 8. Sherwin-Williams Company: www.sherwin-williams.com.
 9. Sika Corporation: www.usa-sika.com.
 10. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 11. W.R. Meadows, Inc: www.wrmeadows.com/sle.

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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.

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- 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 having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- 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.
 - b. Dow Chemical Company; DOWSIL 791 Silicone Weatherproofing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.

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- c. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - d. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
 - e. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com/#sle.
 - f. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
 - g. Sika Corporation; Sikasil WS-295: 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.
 - b. Dow Chemical Company; DOWSIL 999-A Building and Glazing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - c. Pecora Corporation; Pecora 890FTS (Field Tintable Smooth): www.pecora.com/#sle.
 - d. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
 - e. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant: www.sherwin-williams.com/#sle.
 - f. Sika Corporation; Sikasil GP: 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.
 - b. Dow Corning Corporation; 786 Silicone Sealant: www.dowcorning.com.
 - c. Momentive Performance Materials, Inc (GE Silicones products); Silpruf SCS 1700 Sanitary: www.momentive.com.
 - d. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.

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- e. Sika Corporation; Sikasil GP: 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.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 6. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 7. Color: To be selected by Architect from manufacturer's full range.
 - 8. Service Temperature Range: Minus 40 to 180 degrees F.
 - 9. Manufacturers:
 - a. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - b. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
 - c. Sika Corporation; Sikaflex-15 LM: www.usa-sika.com/#sle.
 - d. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. 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.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. 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.

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3. Color: To be selected by Architect from manufacturer's full range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
- G. 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.
 - b. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: www.us.hilti.com/#sle.
 - c. Pecora Corporation: www.pecora.com.
 - d. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
 - e. Specified Technologies Inc; Smoke N' Sound Acoustical Sealant: www.stifirestop.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- H. 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.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 6. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 7. Color: To be selected by Architect from manufacturer's full range.
 8. Service Temperature Range: Minus 40 to 180 degrees F.
 9. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - c. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com/#sle.

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- 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.
 - b. W. R. MEADOWS, Inc; POURTHANE SL: 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.
 - 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.
 - 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:

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- a. Adhesives Technology Corporation; Crackbond JF-311: www.atcepoxy.com/#sle.
- b. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: www.ardexamericas.com/#sle.
- c. Euclid Chemical Company; EUCCO QWIKjoint UVR: www.euclidchemical.com/#sle.
- d. Nox-Crete Inc; DynaFlex JF-85: 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. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 4. 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.

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5. 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. District 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.

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- 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

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**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. GLY - Glynn Johnson, Allegion, PLC.
 - 2. IVE - Ives, Allegion, PLC.
 - 3. KNX/KNO - Knox Company.
 - 4. LCN - LCN Commercial Division, Allegion, PLC.
 - 5. SCE - Schlage Electronic Security, Allegion, PLC
 - 6. SCH/SC - Schlage Lock Company, Allegion, PLC.

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7. VON - Von Duprin, Allegion, PLC..
8. ZER - Zero Industries, Inc., Allegion, PLC.
9. TBD - To be determined.
10. 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 District’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:

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HEADING 01

1 SGL Door 410 KITCHEN / OFFICE
36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T OMEA L583-363	626	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436 OR FS438 AS REQ.	626	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HEADING 02

1 SGL Door 406 KITCHEN / CUST.
36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T OMEA	626	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HEADING 03

1 SGL Door 403 KITCHEN / DRY STORAGE
36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T OMEA	626	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 TBWMS	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ SRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HEADING 04

1 SGL Door 407 KITCHEN / TOILET
36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	L9040 OMEA L583-363 L283-722	626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HEADING 05

1	SGL	Door 408	EXTERIOR / DATA
		36.000 X 84.000 X 1.750 X HMD X HMF X --	
1	SGL	Door 906	EXTERIOR / DATA
1	SGL	Door 912	EXTERIOR / CUSTODIAL
		36.000 X 84.000 X 1.750 X A/G X ALF X --	

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 SH 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T LLL OMEA L283-150	630	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR900	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
1	EA	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

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HEADING 06

- 1 SGL Door 402A EXTERIOR / KITCHEN
48.000 X 96.000 X 1.750 X HMD X HMF X --
- 1 SGL Door 907 EXTERIOR / WEIGHT ROOM
36.000 X 84.000 X 1.750 X HMD X ALF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
1	EA	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

HEADING 07

1 SGL Door 402B SERVICE LINES / KITCHEN
 36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T OMEA L283-711	626	SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 TBWMS	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ SRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HEADING 08

1	SGL	Door 901A	EXTERIOR / SPORTS MEDICINE
1	SGL	Door 901B	EXTERIOR / SPORTS MEDICINE
1	SGL	Door 902A	EXTERIOR / P.E. ATTENDANT/STORAGE
1	SGL	Door 907A	EXTERIOR / WEIGHT ROOM

36.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT (AS REQUIRED)	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT (AS REQUIRED)	689	LCN
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

DOOR SEALS PROVIDED BY ALUMINUM FRAME MANUFACTURER.

HEADING 09
(NO LONGER BEING USED)

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HEADING 10

1 SGL Door 903 EXTERIOR / ELEC
 36.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 SH 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T LLL OMEA L283-150	630	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR900	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
1	EA	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

HEADING 11

1 SGL Door 904 EXTERIOR / BOYS R.R.
 1 SGL Door 905 EXTERIOR / GIRLS R.R.

36.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
1	EA CONT. HINGE	112XY	628	IVE
1	EA CLASSROOM DEAD LOCK	L9463T XB11-720	630	SCH
1	EA PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA PUSH PLATE	8200 8" X 16" CFT	630	IVE
1	EA PULL PLATE	8302 10" 4" X 16" CFC	630	IVE
1	EA SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA FLOOR STOP	FS18L	BLK	IVE
1	EA RAIN DRIP	142AA	AA	ZER
(OMIT WHERE OVERHANG OCCURS)				
1	EA SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA DOOR SWEEP	39A	A	ZER
1	EA THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

HEADING 12

1 SGL Door 909A WEIGHT ROOM / COACHES OFFICE
 1 SGL Door 909B REFLECTION ROOM / COACHES OFFICE

36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA CLASSROOM SECURITY	L9071T OMEA L283-711	626	SCH
2	EA PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA FLOOR STOP	FS436 OR FS438 AS REQ.	626	IVE
1	EA GASKETING	488SBK PSA	BK	ZER

HEADING 13

1 PR Door 910 EXTERIOR / PUBLICATIONS
72.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
2	EA	CONT. HINGE	112XY	628	IVE
1	EA	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D	626	IVE
1	EA	CLASSROOM SECURITY	L9071T OMEA L283-711	626	SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB SERIES	689	IVE
2	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
2	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

DOOR SEALS PROVIDED BY ALUMINUM FRAME MANUFACTURER.

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HEADING 14

1 SGL Door 911 EXTERIOR / UNISEX R.R.
 36.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 SH 4.5 X 4.5 NRP	630	IVE
1	EA	CORRIDOR LOCK	L9456T OMEA L583-363 L283-722	626	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
(OMIT WHERE OVERHANG OCCURS)					
1	EA	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

HEADING 15

1 PR Door 914 EXTERIOR / CLASSROOM
72.000 X 96.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
2	EA	CONT. HINGE	112XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-EO	626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	MORTISE CYLINDER	20-061-ICX (MULLION)	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
4	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4040XP EDA TBWMS	689	LCN
2	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
(OMIT WHERE OVERHANG OCCURS)					
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	MEETING STILE	555AA	AA	ZER
1	EA	MEETING STILE	55AA	AA	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

DOOR SEALS PROVIDED BY ALUMINUM FRAME MANUFACTURER.

HEADING 16

1 PR Door 913 EXTERIOR / CLASSROOM
72.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
2	EA	CONT. HINGE	112XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-EO	626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	MORTISE CYLINDER	20-061-ICX (MULLION)	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
4	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBWMS	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	MEETING STILE	555AA	AA	ZER
1	EA	MEETING STILE	55AA	AA	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

DOOR SEALS PROVIDED BY ALUMINUM FRAME MANUFACTURER.

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HEADING 17

1	SGL	Door 401A	EXTERIOR / SERVICE LINES
1	SGL	Door 401B	EXTERIOR / SERVICE LINES
1	SGL	Door 401C	EXTERIOR / SERVICE LINES
1	SGL	Door 401D	EXTERIOR / SERVICE LINES
1	SGL	Door 401E	EXTERIOR / SERVICE LINES
1	SGL	Door 401F	EXTERIOR / SERVICE LINES

36.000 X 94.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4040XP SHCUSH TBWMS	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT (AS REQUIRED)	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT (AS REQUIRED)	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT (AS REQUIRED)	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
			(OMIT WHERE OVERHANG OCCURS)		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A	ZER

DOOR SEALS PROVIDED BY ALUMINUM FRAME MANUFACTURER.

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HEADING 18

1	RU	Door 907B	EXTERIOR / WEIGHT ROOM
		144.000 X 119.000 X 1.750 X HMD X HMF X --	
1	RU	Door 907C	EXTERIOR / WEIGHT ROOM
		133.000 X 137.000 X 1.750 X HMD X HMF X --	

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
1	EA	CYLINDER OR PADLOCK	MORTISE OR RIM OR PADLOCK AS REQUURED	626	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH

BALANCE OF HARDWARE BY ROLL-UP DOOR MANUFACTURER / SUPPLIER

HEADING 19

1	PR	Door G1	EXTERIOR / SERVICE YARD
1	PR	Door G3	EXTERIOR / SERVICE YARD
		60.000 X 96.000 X 1.750 X CLG X CLF X --	
1	PR	Door G2	SERVICE YARD / TRASH ENCLOSURE
		134.000 X 96.000 X 1.750 X STL X STL X --	
1	PR	Door G4	EXTERIOR / UNKNOWN
1	PR	Door G5	EXTERIOR / UNKNOWN
		71.000 X 100.000 X 1.750 X STL X STL X --	

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
2	EA	CANE BOLT - LOCKABLE	0524.00021 x 0524.00024		RIC
1	EA	PADLOCK L/CYL-FSIC	KS43F3200	606	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH

BALANCE OF HARDWARE PROVIDED BY GATE MFG.

HEADING 20
(NO LONGER BEING USED)

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HEADING 21

1 SGL Door 908 EXTERIOR / REFECTION ROOM
 36.000 X 84.000 X 1.750 X A/G X ALF X --

Each Assembly to have:

Qt	Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	112XY	628 IVE
1	EA	CLASSROOM SECURITY	L9071T OMEA L283-711	626 SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626 SCH
1	EA	SURFACE CLOSER	4040XP EDA TBWMS	689 LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT (AS REQUIRED)	689 LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT (AS REQUIRED)	689 LCN
1	EA	FLOOR STOP	FS18L	BLK IVE
1	EA	RAIN DRIP	142AA	AA ZER
(OMIT WHERE OVERHANG OCCURS)				
1	EA	DOOR SWEEP	39A	A ZER
1	EA	THRESHOLD	AS REQUIRED BY THRESHOLD SILL DETAIL (INCLUDE 103A-MSLA-10 IF NONE SHOWN)	A ZER

DOOR SEALS PROVIDED BY ALUMINUM FRAME MANUFACTURER.

HEADING 22

1 SGL Door G6
 36.000 X 96.000 X 1.750 X CLG X CLF X --

Each Assembly to have:

Qt	Description	Catalog Number	Finish	Mfr
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL-OP-110MD-WH	626 VON
1	EA	RIM CYLINDER	20-057 ICX	626 SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626 SCH
2	EA	PRIMUS CORE	20-740-XP EV29 T	626 SCH
1	EA	DOOR PULL	VR910 NL	630 IVE
1	EA	SURFACE CLOSER	4040XP EDA SRI TBWMS	689 LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT (AS REQUIRED)	689 LCN
1	EA	PA FLUSH PANEL ADAPTER	4040XP-419 SRT (AS REQUIRED)	689 LCN
1	EA	FLOOR STOP	FS18L	BLK IVE

BALANCE OF HARDWARE PROVIDED BY GATE MANUFACTURER.
 PROVIDE REINFORCEMENT AND MOUNTING PLATES FOR DOOR HARDWARE.

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HEADING 23

1 SGL Door 902B WEIGHT ROOM / P.E. ATTANDANT / STORAGE
42.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T OMEA	626	SCH
1	EA	PRIMUS CORE	20-740-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP HEDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436 OR FS438 AS REQ.	626	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HEADING 24

1 PR Door 915
60.000 X 84.000 X 1.750 X WD X HMF X --

Each Assembly to have:

Qt		Description	Catalog Number	Finish	Mfr
	EA	NOTE	REUSE EXISTING HARDWARE		

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. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. 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. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

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- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- I. 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.
- J. 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.
- K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- L. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames.
- M. ITS (DIR) - Directory of Listed Products.
- N. NAAMM HMMA 820 TN03 - Guidelines for Glazing of Hollow Metal Transoms, Sidelights and Windows.
- O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.
- P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
- Q. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames.
- R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
- S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
 - 1. Use 2016 as indicated in 2019 CBC Referenced Standards.
- T. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
 - 1. Use 2017 as indicated in 2019 CBC Referenced Standards.
- V. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- W. UL (DIR) - Online Certifications Directory.
- X. UL 10B - Standard for Fire Tests of Door Assemblies.
 - 1. Use 2008 as indicated in 2019 CBC Referenced Standards.
- Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
 - 1. Use 2009 as indicated in 2019 CBC Referenced Standards.

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.

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- 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.

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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 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 716.5.3.1.
 - 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 716.5.7.

2.02 MANUFACTURERS

- A. Basis of Design Product: B Series Flush Doors as manufactured by Steelcraft, or approved equal.
- B. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - 3. Door Components Inc.; www.doorcomponents.com.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/sle.

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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.
 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: Manufacturers 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.
- a. Model 2 - Seamless.
 - b. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
2. Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
 3. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
 - 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.

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- 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:
 - a. Model 2 - Seamless.
 - b. 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:
 - a. Model 2 - Seamless.
- 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: Fully welded.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 - 3. 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. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

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- G. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
- H. 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.
- I. 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

- 1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
- 2. Size: 20 x 12 inch
 - 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.

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3. Fasteners: Exposed, tamper proof fasteners.
 4. 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 716.6.3 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. 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.
- D. Astragals for Double Doors: Specified in Section 08 7100.
1. Fire-Rated Doors: Steel, shape as required for fire rating.
- E. 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.
- F. 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.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

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- H. 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.
 - a. Dry-pack void when frame set in place.
 - 2. Install anchors for connection to concrete/masonry at each jamb (minimum 3 per jamb).
 - 3. Comply with requirements for fire-rated assembly, including filling frame with solid portland cement grout or firestopping material, as detailed.
- 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.

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- 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

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**SECTION 08 14 16
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; fire rated and non-rated. ST-1

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
- C. NEMA LD 3 - High-Pressure Decorative Laminates.
- D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- E. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
- F. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWMAC/WI (NAAWS).
 - 2. Include certification program label.
- D. Samples: Submit two samples of door veneer, 12 by 12 inches in size illustrating wood grain, stain color, and sheen.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Test Reports: Show compliance with specified requirements for the following:
 - 1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Installer's qualification statement.
- I. Specimen warranty.

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J. Warranty, executed in District's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - 1. Company with at least one project within past five years with value of woodwork within at least 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.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- D. Quality Certification:
 - 1. Provide labels or certificates indicating that installed work will comply 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.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Buell Door Co.: www.eggersonindustries.com.
 - 2. Haley Brothers: www.haleybros.com/#sle.

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3. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
4. Oregon Door: www.oregondoor.com.
5. VT Industries, Inc: www.vtindustries.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 1. Quality Standard: Custom Grade, Standard Duty performance, in accordance with AWMAC/WI (NAAWS) or WDMA I.S. 1A.
 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.
 2. Fire Rated Doors: Tested to 60 minutes and ratings as indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc. (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - a. Comply with CBC Section 716.5.1.
 3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch wg pressure at both ambient and elevated temperatures for "S" label; no additional gasketing or edge sealing allowed.
 - a. Comply with CBC Section 716.5.3.1.
 4. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide flush wood door assemblies in compliance with WDMA I.S. 1A requirements for "S" label; no additional gasketing or edge sealing allowed.
 5. Wood veneer facing with factory transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type staved lumber core (SLC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Architect selected, veneer grade in accordance with quality standard indicated, quarter cut, with slip match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.
 1. Vertical Edges: Any option allowed by quality standard for grade.
 2. "Running Match" each pair of doors and doors in close proximity to each other.

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- 3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
- B. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; color as selected; textured, low gloss finish.
- C. High Pressure Decorative Laminate (HPDL) Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS; color as selected; textured, low gloss finish.
- D. Facing Adhesive: Type II - water resistant.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 11 Polyurethane Catalyzed.
 - 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: Flat.
- B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-6, Catalyzed Polyurethane.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
 - 2. Opaque:
 - a. Manufacturers standard, in compliance with performance duty level indicated.

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- b. Color: As selected by Architect.
- c. Sheen: Satin.
- C. Factory finish doors in accordance with approved sample.
- D. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 11 13.
- B. Metal Louvers:
 - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
 - 2. Louver Blade: Inverted Y blade, sight proof, light proof.
- C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- D. Astragals and Edges for Double Doors: Pairs of doors astragals, and door edge sealing and protection devices.
 - 1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 - 2. Edge Type: Beveled edge
 - 3. Material: Aluminum.
 - 4. Metal Finish: Dark Bronze powder coating.
- E. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install smoke and draft control doors in accordance with NFPA 105 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Field-Finished Doors: Trimming to fit is acceptable.
 - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
 - 2. Trim maximum of 3/4 inch off bottom edges.
 - 3. Trim fire-rated doors in strict compliance with fire rating limitations.
- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.

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- F. Coordinate installation of glazing.
- G. Install door louvers plumb and level.

3.03 TOLERANCES

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

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

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**SECTION 08 31 00
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions.
- B. Section 09 21 16 - Gypsum Board Assemblies: Openings in ceilings.
- C. Section 09 30 00 - Tiling: Tile finishes on and around openings.
- D. Section 09 91 13 - Exterior Painting: Field paint finish.
- E. Section 09 91 23 - Interior Painting: Field paint finish.
- F. Divisions 11: Miscellaneous components requiring access.
- G. Divisions 22, 23, 26, 27, and 28: Mechanical and Electrical components requiring access.
 - 1. Access doors in ductwork.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products.

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.
 - 1. If other than specified products by specified manufacturer, submit product data for each type of access door to be used. Include schedule of access door types, sizes and locations.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
 - 1. For access doors other than shown on Drawings, submit marked floor plan giving locations of all access doors. Submit shop drawing for Architect's review before laying out utility services which require access doors.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Manufacturer'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.

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1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain access doors for entire project from one source from a single manufacturer.
- B. Regulation Requirements: Fire rated access doors shall conform to California Building Code (CBC) Title 24, Part 2, Chapter 7. Panels shall bear the label of Underwriters Laboratories or other testing agency acceptable to the State Fire Marshal.
- C. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door assembly for rating shown, with flush door, frame, hinge, and latch from manufacturer listed in UL - Building Materials Directory. Provide UL label on each fire-rated access door.
- 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.

1.07 PROJECT CONDITIONS

- A. Verification: Obtain specific locations and sizes for required access doors for Work specified in Plumbing, Mechanical, Electrical or other Sections, for access to concealed equipment, and indicate on submitted schedule.
- B. Special-Size Access Doors: Sizes up to 20-inches by 30-inches used where necessary or as indicated. Indicate special size access doors on submitted schedule.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS

- 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.

2.02 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Panel Material: Steel.
 - 3. Size: 12 by 12 inches, nominal minimum.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

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5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- B. 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.
 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- C. 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.
 5. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
- D. Ceiling-Mounted Units:
1. Location: As indicated on drawings.
 2. Panel Material: Aluminum extrusion with gypsum board inlay.
 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 4. Size - Other Ceilings: 12 inch by 12 inch, nominal minum.
 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 6. Ceiling Doors and Panels: Open with allen wrench - no keys.
 7. Ceiling Doors and Panels: Include a retention spring or bar to keep door from falling open rapidly.

2.03 WALL AND CEILING MOUNTED ACCESS UNITS

- A. Manufacturers:
1. Activar Construction Products Group - JL Industries: www.activarcpg.com/#sle.
 2. ACUDOR Products Inc: www.acudor.com/#sle.
 3. Babcock-Davis: www.babcockdavis.com.
 4. Cendrex, Inc: www.cendrex.com/#sle.

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5. Larsen's Manufacturing Co.: www.larsensmfg.com.
 6. Karp Associates, Inc: www.karpinc.com.
 7. Milcor, Inc: www.milcorinc.com.
 8. Nystrom, Inc: www.nystrom.com.
 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: As indicated on drawings.
 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. Heavy Duty Single Steel Sheet Door Panels: 14 gauge, 0.0747 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.
- C. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
1. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
 2. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
 3. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
 4. Door/Panel Size: As indicated on the drawings.
 5. 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.

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- D. 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, in compliance with requirements of listing authority..
- 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.

END OF SECTION

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**SECTION 08 33 13
COILING COUNTER DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated coiling counter doors and operating hardware. STL-2
- B. Electric motor operation; wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Rough openings.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Division 26- Electrical:
 - 1. Power to disconnect.
 - 2. Conduit from electric circuit to operator and from operator to control station.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. CBC - California Building Code.
- F. ITS (DIR) - Directory of Listed Products.
- G. NEMA MG 1 - Motors and Generators.
- H. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish.
- C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 4 inch long, illustrating shape, color and finish texture.
- E. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.

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- F. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.
- G. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

1.05 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 WARRANTY

- A. Standard Warranty: Two years from date of substantial completion against defects in material and workmanship.
- B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Provide labeled fire resistive doors meeting the requirements of the California Code of Regulations (CCR), Title 24, Part 2 California Building Code Chapter 7 Fire Resistance - Rated Construction for the fire resistive ratings indicated. Fire resistive doors shall bear labels of Underwriters' Laboratory (UL), Factory Mutual (FM), or other testing agency acceptable to the State Fire Marshal
- B. Comply with CBC Section 715.

2.02 MANUFACTURERS

- A. Coiling Counter Doors:
 - 1. Basis of Design Product: Model 650 as manufactured by Overhead Door, or approved equal.
 - 2. Acceptable Manufacturers:
 - a. Clopay Building Products : www.clopaydoor.com.
 - b. The Cookson Company : www.cooksondoor.com.
 - c. Cornell Iron Works : www.cornelliron.com.
 - d. Overhead Door Corp. : www.overheaddoor.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 COILING COUNTER DOORS

- A. Coiling Counter Doors, Non-Fire-Rated: Galvanized steel slat curtain.

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1. Mounting: As indicated on drawings.
2. Provide integral frame and sill of same material and finish.
3. Nominal Slat Size: 1-1/2 inches wide.
4. Slat Profile: Flat.
5. Finish: Factory powder coated.
6. STL-2 Color: As indicated on drawings.
7. Guides: Formed track; same material and finish unless otherwise indicated.
8. Hood Enclosure: Manufacturer's standard; primed steel.
9. Electric operation.
10. Locking Devices: Lock and latch handle on outside.

2.04 INTEGRAL COUNTERTOP

- A. Countertop: Integral 14 gauge AISI 300 series stainless steel formed shape; No. 4 finish.

2.05 MATERIALS

- A. Curtain Construction: Interlocking, single thickness slats.
 1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 16 gauge, 0.06 inch.
 4. Stainless Steel Slats: ASTM A666, Type 304; minimum thickness [CHOICE TEXT].
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
 1. Guides for Galvanized Curtains: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A 123/A 123M.
- C. Guide Finish: Match slat powder coating (for Steel Slat with Powder Coating)
- D. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
- E. Lock Hardware:
 1. For motor operated units, additional lock or latching mechanisms are not required.
- F. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb maximum force to operate.
- G. Weather Seals: Provide vinyl or neoprene weatherstripping for exterior exposed doors except where otherwise noted.
 1. Door Heads: Use 1/8-inch thick continuous sheet secured to inside of curtain coil hood.
 2. Door Jambs: Use 1/8-inch thick continuous strip secured to exterior side of jamb guide.

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2.06 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction (AHJ) as suitable for purpose specified and indicated.
 - 1. Provide interlock switches on motor operated units.
 - 2. Provide tamper-proof operation cycle counter.
- B. Electric Operators:
 - 1. Mounting: Concealed Tubular Mounted.
 - 2. Motor Enclosure: NEMA MG 1.
 - 3. Motor Rating: As recommended by manufacturer; continuous duty.
 - 4. Motor Voltage: 110 volt, single phase, 60 Hz.
 - 5. Opening Speed: 6 inches per second.
 - 6. Manual override in case of power failure.
- C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each electrical operator.
 - 1. Controls: 24 VAC circuit.
 - 2. Recessed Flush.
 - 3. Switch type: Toggle, NEMA 1.
- D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26.
- F. Complete wiring from disconnect to unit components.
- G. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.
- H. Install perimeter trim as indicated.

3.03 TOLERANCES

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

3.04 FIELD QUALITY CONTROL

- A. Completed Installation: Coiling doors shall be free from warps, twists and other distortions, and operate freely.
- B. Demonstration: Upon completion of installation and for Substantial Completion review, demonstrate proper operation of each coiling door.
 - 1. Open and close each motorized coiling door 5 cycles with motor-operator and 1 cycle with manual operator.

3.05 ADJUSTING

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

3.06 CLEANING

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

END OF SECTION

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**SECTION 08 33 23
OVERHEAD COILING DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior coiling doors. STL-1
- B. Electric operators and control stations.
- C. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 36 13 - Sectional Doors.
- C. Division 26 - Electrical:
 - 1. Conduit from electric circuit to operator and from operator to control station.
 - 2. Conduit from fire alarm system.
 - 3. Power to disconnect.
- D. Section 28 46 00 - Fire Detection and Alarm: Fire alarm interconnection.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. CBC - California Building Code.
- E. ITS (DIR) - Directory of Listed Products.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- H. NEMA MG 1 - Motors and Generators.
- I. CEC - California Electrical Code
 - 1. NFPA 70 - National Electrical Code.
- J. UL (DIR) - Online Certifications Directory.
- K. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 SUBMITTALS

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

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- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 2 x 4 inch in size illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.
- I. Executed warranties.
- J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.
- K. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products 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 documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer Warranty: Provide lifetime manufacturer warranty for counterweights and tension springs. Complete forms in District's name and register with manufacturer.

1.07 WARRANTY

- A. Standard Warranty: Two years from date of substantial completion against defects in material and workmanship.
- B. Maintenance: Submit for District's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS:

- A. Provide labeled fire resistive doors meeting the requirements of the California Code of Regulations (CCR), Title 24, Part 2 California Building Code Chapter 7 Fire Resistance - Rated

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Construction for the fire resistive ratings indicated.

- B. Fire resistive doors shall bear labels of Underwriters' Laboratory (UL), Factory Mutual (FM), or other testing agency acceptable to the State Fire Marshal.
- C. Comply with CBC Section 715.

2.02 MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. Basis of Design: Overhead Door Corporation; Product Rolling Steel Door, Model 610: www.overheaddoor.com.
 - 2. Clopay Building Products: www.clopaydoor.com/#sle.
 - 3. Cornell Iron Works, Inc: www.cornelliron.com/#sle.
 - 4. The Cookson Company; Thermiser Model ESD20: www.cooksondoor.com/#sle.
 - 5. Overhead Door Corporation: www.overheaddoor.com.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain; insulated; manual operation.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf without undue deflection or damage to components.
 - 2. Nominal Slat Size: 3 inches wide x required length.
 - 3. Finish: Factory painted, color as selected.
 - 4. Guides: Angles; galvanized steel.
 - 5. Hood Enclosure: Manufacturer's standard; galvanized steel.
 - 6. Electric operation.
 - 7. Mounting: As indicated on drawings.
 - 8. Locking Devices: Chain lock keeper on inside.

2.04 MATERIALS AND COMPONENTS

- A. Metal Curtain Construction: Interlocking slats.
 - 1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, where curtain enters hood enclosure, and UL requirements of doors indicated.
 - 4. Steel Slats: Minimum thickness, 22 gage, 22 inch; ASTM A653/A653M galvanized steel sheet.
 - a. Galvanizing: Minimum G90 coating.

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- B. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.
- C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
 - 1. Hot-dip galvanized in compliance with ASTM A123/A123M.
 - 2. Prime painted.
- D. Guides - Sheet Metal: Formed from sheet metal, [] gauge, [] inch thick; [] inch wide.
 - 1. Hot-Dip Galvanizing: Minimum G90 coating, in compliance with ASTM A653/A653M.
- E. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
 - 1. Prepare for site painted finish.
- F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.05 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
 - 2. Provide tamperproof operation cycle counter.
- B. Electric Operators:
 - 1. Mounting: Side mounted.
 - 2. Motor Enclosure:
 - a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
 - 3. Motor Rating: 1/2 hp; continuous duty.
 - 4. Motor Voltage: 120 volts, single phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA 250, Type 4.
 - 7. Opening Speed: 12 inches per second.
 - 8. Brake: Manufacturer's standard type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. See Section 26 05 83 for electrical connections.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with CEC / NFPA 70.
- D. Control Station: Key operated standard three button (OPEN-STOP-CLOSE) momentary control for each operator.
 - 1. 24 volt circuit.

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2. Surface mounted, at exterior location as indicated on drawings.
3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, or NEMA 1 photo eye sensors as required with momentary-contact control device.
 - b. Secondary Device: Provide electric sensing edge with wireless edge kit or non-monitored safety edge as an option along with continuous-constant control device.
- E. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26.
- F. Complete wiring from disconnect to unit components.
- G. Install enclosure and perimeter trim.

3.03 TOLERANCES

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

3.04 FIELD QUALITY CONTROL

- A. Completed Installation:
 1. Free from warps, twists and other distortions, and operate freely.
- B. Demonstration: Upon completion of installation and for Substantial Completion review, demonstrate proper operation of each coiling door.
 1. Open and close each motorized coiling door 5 cycles with motor-operator and 1 cycle with manual operator.

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3.05 ADJUSTING

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

3.06 CLEANING

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

END OF SECTION

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**SECTION 08 36 13
SECTIONAL DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated. ALUM-2
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.
- B. Section 06 10 00 - Rough Carpentry: Rough wood framing and blocking for door opening.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Division 26 - Electrical:
 - 1. Conduit from electric circuit to operator and from operator to control station.
 - 2. Empty conduit from control units to door operator.
 - 3. Electrical service to disconnect located near door operator.

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 B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- D. ASTM C1036 - Standard Specification for Flat Glass.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- F. 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.
- G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- H. DASMA 102 - American National Standard Specifications for Sectional Doors.
- I. ITS (DIR) - Directory of Listed Products.
- J. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- K. NEMA MG 1 - Motors and Generators.
- L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

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- M. NFPA 70 - National Electrical Code.
- N. UL (DIR) - Online Certifications Directory.
- O. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Operation Data: Include normal operation, troubleshooting, and adjusting.
- H. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products 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 documented experience.
- C. Comply with applicable code for motor and motor control requirements.
- D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.
- D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Model 511 manufactured by Overhead Door, www.overheaddoor.com.
- B. Sectional Doors:
 - 1. C.H.I. Overhead Doors: www.chiohd.com/#sle.

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2. Clopay Corporation: www.clopaydoor.com.
3. Raynor Garage Doors: www.raynor.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM DOORS

- A. Aluminum Doors: Stile and rail aluminum with glazed panels; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
 2. Door Nominal Thickness: 1-3/4 inches thick.
 3. Thermal Transmittance: U-factor of 0.31 Btu/hr sq ft degrees F, maximum, in accordance with DASMA 102.
 4. Air Leakage Rate: Less than 0.40 cfm/sf when tested in accordance with ASTM E283 at test pressure difference of 1.57 psf.
 5. Finish: Factory anodized; color as selected by Architect.
 6. Glazed Lights: Full panel width, each row; set in place with resilient glazing channel.
 7. Electric Operation: Electric control station.
- B. Door Panels: Paneled aluminum construction; extruded aluminum stiles and rails; 1/8 inch thick infill panels of sheet aluminum; stile and rail joints welded; rabbeted weather joints at meeting rails.
- C. Window Frame: Manufacturers standard, finish to match.
- D. Glazing: Fully tempered glass; insulated glass units; clear; 1/2 inch overall thickness.

2.03 COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Springs: 100,000 cycles.
- D. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
- E. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- F. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- G. Head Weatherstripping: EPDM rubber seal, one piece full length.
- H. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

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- I. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

2.04 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Aluminum Sheet: ASTM B209/B209M, 5005 alloy, H14 temper, plain surface.
- C. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- D. Float Glass: Provide float glass glazing, unless noted otherwise.
 - 1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
 - 3. Tinted Types: Color and performance characteristics as indicated.
- E. Insulation: Foamed-in-place polyurethane, bonded to facing.
 - 1. Same thickness as core framing members.

2.05 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
 - 2. Provide tamperproof operation cycle counter.
- B. Electric Operators:
 - 1. Mounting: Side mounted on cross head shaft.
 - 2. Motor Enclosure:
 - a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
 - 3. 1/2 hp; manually operable in case of power failure, transit speed of 12 inches per second.
 - 4. 208/230 volts, three phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA 250, Type 1.
 - 7. Opening Speed: 12 inches per second.
 - 8. Brake: Adjustable friction clutch type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. Refer to Section 26 05 83 for electrical connections.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.

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1. 24 volt circuit.
2. Surface mounted, at interior door jamb.
3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.
- F. Provide interconnection to security system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.
- G. Install perimeter trim and closures.

3.04 TOLERANCES

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

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3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass. AULM-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 06 10 00 - Rough Carpentry: Attachment to wood.
- C. Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- D. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- E. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- F. Section 08 80 00 - Glazing: Glass and glazing accessories.
- G. Section 12 24 00 - Window Shades: Attachments to framing members.

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 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

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- J. 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.
- K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- L. CBC Chapters 20 and 24.
- M. 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 Division of the State Architect 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.

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- 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.
- M. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

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.

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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 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Front-Set Style, Thermally-Broken:
 1. Basis of Design: Arcadia Corp; Offset Glazed System TC470 Series - Thermal - Shear Block Inside Set: www.arcadiainc.com.
 2. Basis of Design: Arcadia Corp; Offset Glazed System TC670 Series - Thermal - Shear Block Inside Set: www.arcadiainc.com.
 3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 4. Vertical Mullion Dimensions: 2 inches wide by 6 inches deep.

2.02 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Insulating Glazing, Thermally-Broken:
 1. Basis of Design: Arcadia Corp; WS512HD Series Heavy Duty Wide Stile: www.arcadiainc.com.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 1. Arcadia, Inc: www.arcadiainc.com/#sle.
 2. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

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1. For any product not identified as "Basis of Design", submit information as specified for substitutions.
2. For any product not identified as "Basis of Design", submit information as specified for substitutions.
3. Substitution may or may not be accepted after Architect and District review with complete evaluation for content and schedule impact.
4. Substitutions shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revision to shop drawings illustrating changes is not considered adequate for DSA review and approval.
5. Substitutions may be acceptable, based on Architect's review and approval, for submittal to DSA.
 - a. If substituted manufacturer cannot reproduce design and DSA 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 DSA submittal and DSA approval is required prior to installation.

2.03 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. 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.
 3. Finish Color: As indicated on the drawings.
 4. 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.
 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. 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.

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8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
11. 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. Resistance to Forcible Entry: Jambs adjacent to door locks shall resist a force of 1600 pounds.

2.04 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 1. Glazing Stops: Flush.
 2. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 08 80 00.
- C. Swing Doors: Glazed aluminum.
 1. Thickness: 1-3/4 inches.
 2. Top Rail: 6 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.

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2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM 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.
- K. Glazing Accessories: As specified in 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.

2.06 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 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: As specified in 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.

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- 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 wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

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

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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

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SECTION 08 56 59
SERVICE AND TELLER WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Service and teller windows.

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 - Architectural Wood Casework: Mounting surface.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- E. CBC - California Building Code.
- F. CBC Ch. 11B - California Building Code-Chapter 11B.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.
- B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.
- C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.
- D. Manufacturer Qualification Statement.
- E. Installer Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports

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showing that their standard manufactured products meet the specified requirements.

- 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 units in manufacturer's original packaging and unopened containers with identification labels intact.
- B. Store units in area protected from exposure to weather and vandalism.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Pass-through windows of sales/service counter shall comply with the reach and access requirements of CBC Sections 11B-227.3 Counters, 11B-305 Clear Floor or Ground Space, 11B-306 Knee and Toe Clearance, 11B-308 Reach Range, 11B-309 Operable Parts, and 11B-904 Check-out aisles and sales and service counters.
- B. Where glazed openings are provided in accessible rooms or spaces for operation by occupants, at least one shall comply with CBC Ch. 11B-229.1 and 11B-309.
- C. Comply with requirement of CBC Chapter 24.

2.02 SERVICE AND TELLER WINDOWS

- A. Location: Built within exterior wall, as indicated on drawings.
- B. Type of Use: As indicated on drawings.
- C. Glazing: Single (monolithic), clear.
 - 1. Tempered safety glazing with polished edges.
 - 2. Frameless Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of full-width and height glass panels supported by single point stainless steel fittings and holes through glass.
 - a. Configuration: As indicated on drawings.
 - b. Glass Panel Thickness: 3/8 inch, tempered glass.
 - c. Designed to withstand normal operation without damage, racking, sagging, or deflection.
 - d. Coordinate wall assembly preparation and provide hardware as necessary for fully operable installation.
 - e. Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.
- D. Counter Staging Area: Attendant-side.
- E. Communication: Standard talk-through portal. Mounted at 48 inches AFF.

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1. Material: 11 Gauge Stainless Steel.
2. Finish: #4 Brushed.
3. Basis of Design Product: Model SST5, Stainless Steel Speak-Thru as manufactured by CR Laurence, www.crlaurence.com, or approved equal.

2.03 PASS THROUGH WINDOW

- A. Pass-Through Window:
1. Location: Exterior.
 2. Window: Horizontal Sliding; Fixed Side Panel.
 - a. Operation: Manual.
 - b. Mounting: As indicated on Drawings.
 - c. Size: As indicated on drawings.
 - d. Finish: Colored anodized.
 - e. Screen: None.
 3. Glazing: Insulating, clear.
 - a. Tempered safety glazing.
 4. Counter Staging Area: Attendant-side.
 5. Products:
 - a. Basis of Design: Arcadia Corp.; Sliding 2820 Pass Thru Series (Non-Thermal): www.arcadiainc.com.
 - b. C.R. Lawrence; CRL Horizontal Sliding Service Windows, DW Series: www.crl-arch.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ASSEMBLY COMPONENTS

- A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
 2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
 3. Apply factory finish to exposed surfaces.
 4. Apply bituminous paint to concealed metal surfaces in contact with cementitious or dissimilar materials.
 5. Wind Design: Design and size components to withstand dead loads and live loads caused by pressure and negative wind loads acting normal to plane of window as calculated in accordance with applicable code.

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2.05 MATERIALS

- A. Aluminum Extrusions: Minimum 1/8 inch thick frame and sash material complying with ASTM B221 and ASTM B221M.
 - 1. Finish: Class I color anodized.
- B. Insulating Glass: Double pane insulating vision glass; 5/8 inch thick, minimum.
 - 1. Low-E coating on No. 2 surface.

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.

2.07 ACCESSORIES

- A. Hardware and Security Devices for Sliding Windows:
 - 1. Hook-Lock: Maximum security hook lock on each slider.
 - 2. Weatherstripping and Glazing Sealant: Factory applied.
 - 3. Bottom Sills: Stainless steel construction, no bottom tracks and no pop rivets.
 - 4. Handles: Stainless steel, manufacturer's standard profile and finish.
 - a. Operating Force: 5 lbs maximum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that window openings are ready for installation of windows.
- B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.
- C. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install units in correct orientation (inside/outside or secure/non-secure).
- C. Anchor units securely in manner so as to achieve performance specified.
- D. Remove and replace defective work.

3.03 ADJUSTING

- A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure and a tight fit at the contact points; lubricate operating hardware.

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3.04 CLEANING

- A. Remove protective material from factory finished surfaces.
- B. Clean exposed surfaces promptly after installation without damaging finishes.

3.05 PROTECTION

- A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

END OF SECTION

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**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 00 - 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 00 - Fire Detection and Alarm: Electrical connection to activate door closers.
- K. Section 32 31 13 - Chain Link Fences and Gates.
- L. Section 32 31 19 - Decorative Metal Fences and Gates.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. BHMA (CPD) - Certified Products Directory.
- C. BHMA A156.1 - Standard for Butts and Hinges.
- D. BHMA A156.3 - Exit Devices.
- E. BHMA A156.4 - Door Controls - Closers.
- F. BHMA A156.5 - Cylinders and Input Devices for Locks.
- G. BHMA A156.6 - Standard for Architectural Door Trim.

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- H. BHMA A156.7 - Template Hinge Dimensions.
- I. BHMA A156.8 - Door Controls - Overhead Stops and Holders.
- 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 Steel Frames.
- S. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames.
- T. DHI (H&S) - Sequence and Format for the Hardware Schedule.
- U. DHI (KSN) - Keying Systems and Nomenclature.
- V. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
- W. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors.
- X. ITS (DIR) - Directory of Listed Products.
- Y. NFPA 70 - National Electrical Code.
- Z. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- AA. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- BB. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- CC. UL (DIR) - Online Certifications Directory.
- DD. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
- EE. 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.

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- 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. District 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 District 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, District, participants, and those affected by decisions made.
 - a. Furnish District's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the District.
 - 7. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. 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.

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- C. 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.
- D. 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.
- E. 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.
- F. 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.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. 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.
- I. Keying Schedule:

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1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- J. Manufacturer's qualification statement.
- K. Installer's qualification statement.
- L. Supplier's qualification statement.
- M. District 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 District.
 4. Provide District 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.
- N. Manufacturers' certificates that fire-rated hardware meets or exceeds specified requirements.
- O. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.
- 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 District'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.

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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. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
 - 1. Mechanical Closers: Thirty years, minimum.
 - 2. Electrical Closers: As indicated, minimum.
 - 3. Mechanical Exit Devices: Three years, minimum.
 - 4. Electrical Exit Devices: One year, minimum.
 - 5. Locksets and Cylinders: Three years, minimum.
 - 6. Other Hardware: Two years, minimum.

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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.

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- 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 DSA 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.
5. SB 211 - DSA Bulletin 11-05

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- a. Provide all latching devices that are lockable (including but not limited to door locks and panic/exit devices) that comply with CBC 1010.1.11:
 - 1) All new construction projects to include locks that allow the doors to be locked from the inside.
 - 2) The requirement applies to classrooms and any other room with an occupancy of 5 or more persons, but does not include doors that are locked from the outside at all times or student restrooms.
- D. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Comply with SB 211 (DSA Bulletin 11-05); CBC section 1010.1.11.
 - 3. Accessibility: ADA Standards, CBC Chapter 11B.
 - 4. 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.
 - 5. 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.
 - 6. 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.
 - 7. Listed and certified compliant with specified standards by BHMA (CPD).
 - 8. Auxiliary Hardware: BHMA A156.16.
 - 9. Straps and Tee Hinges: BHMA A156.20.
 - 10. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 11. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
 - 12. 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.

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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: Ives.
2. Ives, an Allegion brand: www.allegion.com/us.
3. Bommer Industries, Inc: www.bommer.com.
4. Select Hinges : www.select-hinges.com
5. 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.

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- 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.
 - 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.
- 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. Basis of Design: Ives.

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2. Ives, an Allegion brand: www.allegion.com/us/#sle.
 3. Door Controls International: www.doorcontrols.com.
 4. 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. Comply with SB 211 (DSA Bulletin 11-05); CBC section 1010.1.11.
- B. Manufacturers:
1. Basis of Design: Von Duprin, District Standard.
 2. Von Duprin, an Allegion brand: www.allegion.com/us/#sle.
 3. Substitutions: Not permitted.
- C. 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.
 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 California State CBC Chapter 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 1010.1.9 and State Fire Marshal Standard 12-10-3 Exits, Section 12-10-302.
 - a. Mechanical Method: Von Duprin "AX-" feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
 8. Trim to meet BHMA A156.3 Trim Security Test.
 9. Provide weather-resistant devices when installed on exterior gates.
 10. Independent lab-tested 1,000,000 cycles.

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11. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
12. For electrical options, provide quick connect plug-in pre-wired connectors.

2.05 LOCK CYLINDERS

- A. Manufacturers:
 1. Basis of Design: Schlage, District Standard.
 2. Schlage, an Allegion brand: www.allegion.com/us/#sle.
 3. 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 MORTISE LOCKS

- A. Comply with SB 211 (DSA Bulletin 11-05); CBC section 1010.1.11.
- B. Manufacturers:
 1. Basis of Design: Schlage L series, 03N design, District Standard.
 2. Schlage, an Allegion brand: www.allegion.com/us/#sle.
 3. Substitutions: Not permitted.
- C. 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.

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- 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.

2.07 DOOR PULLS AND PUSH PLATES

- A. Manufacturers:
- 1. Basis of Design: Ives.
 - 2. Ives, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 4. Trimco: www.trimcohardware.com/#sle.
 - 5. Substitutions: Not permitted.
- B. Anti-Vandal Pull Manufacturers:
- 1. Basis of Design: Trimco, District Standard.
 - 2. Trimco: www.trimcohardware.com/#sle.
 - 3. Substitutions: Not permitted.
- C. 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.

2.08 COORDINATORS

- A. Manufacturers:
- 1. Basis of Design: Ives.
 - 2. Ives, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Door Controls International: www.doorcontrols.com.

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4. Substitutions: Not permitted.
- B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
 1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.09 CLOSERS

- A. Manufacturers; Surface Mounted:
 1. Basis of Design: LCN 4040XP / 4041 series, District Standard.
 2. LCN, an Allegion brand: www.allegion.com/us/#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.

2.10 HYDRAULIC GATE CLOSER AND HINGE

- A. Basis of Design Product: Mammoth 180 with Dino hinge as manufactured by Loconix, or approved equal.
- B. Self Closing Hinges: Comply with BHMA A156.17.
- C. Description:
 1. 100% mechanical (no electronic components).
 2. Closing Speed: Adjusting a valve with an Allen key.
 3. Closing Force: Adjustable to maximum 5 lbs operating force. Comply with ADA Standards and CBC Ch. 11B.
 4. Allow for a 180 degrees opening angle of the gate.
 - a. When opened 180 degrees, the gate closer should self-close over the 180 degrees.
 5. Include corresponding bottom hinge.
 6. Dampening Mechanism: Hydraulic .

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7. The gate closer should have double rubber sealings to avoid oil leakage at all times.
8. Color: Black or silver color, as selected by Architect.

D. Performance

1. The gate closer shall be specifically made for outdoor use (IP69).
2. Gates up to 330 lbs and gate width up to 5 feet.
3. The opening pressure of the gate closer shall be between 3 and 5 lbs. maximum over the full 180 degrees.
4. Guarantee the hydraulic dampening to work properly under all temperature circumstances without any summer or winter adjustments, measured at a 90° opening. The viscosity of the oil shall have no impact on the performance of the gate closer.
 - a. The closing time shall not be below 10 seconds at 70 degrees Celsius (summer).
 - b. The closing time shall not be longer than 30 seconds at -30 degrees Celsius (winter).
5. Tested for 500,000 movements.
6. Maintenance free (no greasing nor oil refill).
7. Manufacturer Warranty: 3 years.

2.11 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:

1. Basis of Design: Glynn-Johnson.
2. Glynn-Johnson, an Allegion brand; [____]: www.allegion.com/us/#sle.
3. ABH Manufacturing Inc.: www.abhmfg.com.
4. Substitutions: Not permitted.

B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.

1. Provide stop for every swinging door, unless otherwise indicated.
2. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.

2.12 KICK PLATES

A. Manufacturers:

1. Basis of Design: Ives.
2. Ives, an Allegion brand: www.allegion.com/us/#sle.
3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
4. Trimco: www.trimcohardware.com/#sle.
5. 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: 12 inch high by 2 inch less door width (LDW) on push side of door.

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2.13 DOOR HOLDERS

- A. Manufacturers:
 - 1. Basis of Design: Ives.
 - 2. Ives, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 4. Trimco: www.trimcohardware.com/#sle.
 - 5. Substitutions: Not permitted.
- B. Door Holders: Comply with BHMA A156.16, Grade 1.
 - 1. Provide surface mounted door holders when wall or floor stop is not applicable and hold-open device is mounted on door.
 - 2. Type: Lever, or kick down stop, with rubber bumper at bottom end.
 - 3. Material: Stainless steel.

2.14 FLOOR STOPS

- A. Manufacturers:
 - 1. Basis of Design: Ives.
 - 2. Ives, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 4. Trimco: www.trimcohardware.com/#sle.
 - 5. Substitutions: Not permitted.
- B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
 - 2. Type: Manual hold-open, with pencil floor stop.
 - 3. Material: Aluminum housing with rubber insert.

2.15 WALL STOPS

- A. Manufacturers:
 - 1. Basis of Design: Ives.
 - 2. Ives, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 4. Trimco: www.trimcohardware.com/#sle.
 - 5. 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.

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2. Type: Bumper, concave, wall stop.
3. Material: Aluminum housing with rubber insert.

2.16 THRESHOLDS

- A. Manufacturers:
 1. Basis of Design: Zero.
 2. Zero International, Inc: www.zerointernational.com/#sle.
 3. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 4. National Guard Products, Inc: www.ngpinc.com/#sle.
 5. 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.

2.17 WEATHERSTRIPPING AND GASKETING

- A. Rigid Seals:
 1. Manufacturers:
 - a. Basis of Design: Pemko, District Standard.
 - b. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - c. 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.

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- f. See Section 08 1416 when wood door to frame sealing system is applied by door manufacturer.
- g. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
- h. Provide door bottom sweep on each exterior door, unless otherwise indicated.
- i. 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.

B. Adhesive Seals and Bottoms:

1. Manufacturers:

- a. Basis of Design: Zero International, Inc.
- b. Zero International, Inc: www.zerointernational.com/#sle.
- c. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
- d. National Guard Products, Inc: www.ngpinc.com/#sle.
- e. Substitutions: Not permitted.

2. Weatherstripping and Gasketing: Comply with BHMA A156.22.

- a. Head and Jamb Type: Self-adhesive.
- 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. Refer to Section 08 1416 when wood door to frame sealing system is applied by door manufacturer.
- g. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated; .
- h. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.18 PADLOCKS

A. Padlocks: Solid extruded brass case with shackle that locks at heel and toe.

- 1. Shackle Height: 3/4 inch, and width of opening is 7/8 inch.
- 2. Shackle Diameter: 1/4 inch.

2.19 SIGNAGE

A. See Section 10 14 00 for additional signage requirements.

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2.20 SILENCERS

- A. 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.

2.21 KEY CONTROL SYSTEMS

- A. Manufacturers:
 - 1. Basis of Design: Schlage, District Standard.
 - 2. Schlage, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Substitutions: Not permitted.
- B. 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 District'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 District 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 District's written approval of the system.
 - 5. Supply keys in following quantities:
 - a. 4 each Master keys.
 - b. 1 each Grand Master keys.
 - c. 6 each Construction Master keys.
 - d. 15 each Construction keys.
 - e. 2 each Construction Control keys.
 - f. 2 each Control keys if new system.
 - g. 2 each Extra Cylinder cores.
 - h. 2 each Change keys for each keyed core.

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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 District by security shipment direct from hardware supplier.
10. Bitting List: Use secured shipment direct from point of origination to District 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."

2.22 KEY CABINET

- A. Manufacturers:
 1. Basis of Design: Lund Equipment.
 2. Lund Equipment: www.lundkeycab.net.
 3. Telkee: www.telkee.com.
 4. 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.

2.23 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.
 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:

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- 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).

2.24 POWER SUPPLY

- A. Manufacturers:
 - 1. Basis of Design: Von Duprin.
 - 2. Von Duprin, an Allegion brand: www.allegion.com/us/#sle.
 - 3. Substitutions: Not permitted.
- B. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
 - 1. Power: 24 VAC, 10 Amp; with 120 VAC power supply.
 - 2. Operating Temperature: 32 to 110 degrees F.
 - 3. Provide with emergency release terminals that release devices upon activation of fire alarm system.

2.25 FINISHES

- A. Finishes: Identified in Section 08 0671 - Door Hardware Schedule.

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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 District.

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 District 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.

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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 1010.1.9.2, 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 that 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.

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- 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 District'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/District.
- F. Final inspection: Installer to provide letter to District that upon completion installer has visited the Project and has accomplished the following:
 - 1. Has re-adjusted hardware.

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2. Has evaluated maintenance procedures and recommend changes or additions, and instructed District'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 District 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 District's personnel.
 3. Has identified items that have deteriorated or failed.

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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

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**SECTION 08 80 00
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic films. GF-1
- D. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers.
- B. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- E. 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. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- F. ASTM C1036 - Standard Specification for Flat Glass.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered 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. CBC - California Building Code.
- M. GANA (GM) - GANA Glazing Manual.
- N. GANA (SM) - GANA Sealant Manual.
- O. GANA (LGRM) - Laminated Glazing Reference Manual.

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- P. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
- Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- S. 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. Certificate: Certify that products of this section meet or exceed specified requirements.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for District'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), GANA (LGRM), 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.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
 - 1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

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- a. North American Contractor Certification (NACC) for glazing contractors.
- b. Equivalent independent third-party ANSI accredited certification.
- D. 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. Provide mock-up of each type of glazing system including glass and air barrier and vapor retarder seal.
- C. Provide on-site glazing mock-up with the specified glazing components.
- D. Locate where directed.
- E. Mock-ups may not remain as part of the Work.

1.08 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.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- 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.
- C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, 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.

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- 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 MANUFACTURERS

A. Glass Fabricators:

- 1. Glasswerks Inc.: www.glasswerks.com.
- 2. GlasPro, Inc.: www.glas-pro.com
- 3. Standard Bent Glass Corp: www.standardbent.com/#sle.
- 4. Viracon, Inc: www.viracon.com/#sle.
- 5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Float Glass Manufacturers:

- 1. AGC Glass North America, Inc: www.agcglass.com/#sle.
- 2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
- 3. GlasPro, Inc.: www.glas-pro.com
- 4. Guardian Glass, LLC: www.guardianglass.com/#sle.
- 5. Pilkington North America Inc: www.pilkington.com/na/#sle.
- 6. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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

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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. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
1. In conjunction with weather barrier related materials described in other sections, as follows:
 - a. Water-Resistive Barriers: See Section 07 25 00.
 2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.
 3. To maintain a continuous vapor retarder and/or air barrier throughout 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.

2.04 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.
 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
 6. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.05 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.
 4. Cardinal Glass Industries: www.cardinalcorp.com/#sle.

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5. Glasswerks: glasswerks.com.
 6. Pilkington North America Inc: www.pilkington.com/na/#sle.Pilkington North America Inc: www.pilkington.com/na/#sle.
 7. Viracon, Apogee Enterprises, Inc: www.viracon.com/#sle.
 8. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 9. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. 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.
 7. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
 - a. Inert gas may be installed in the field into air space in accordance with insulating glass fabricator's and installer's requirements.
- D. Type GL-1T - Insulating Glass Units: Safety glazing.
1. Applications:
 - a. Glazed lites in exterior doors.
 - b. Glazed sidelights and panels next to doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 2. Space between lites filled with air.
 3. Glass Type: Same as Type GL-1 except use fully tempered float glass for both outboard and inboard lites.
 4. Total Thickness: 1 inch.
 5. Metal edge spacer.
 6. Glazing Method: Dry glazing method, gasket glazing.

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2.06 BASIS OF DESIGN - INSULATING GLASS UNITS

- A. Type GL-1 - 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), Summer - 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. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 10. 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.
 11. Metal Edge Spacers: Aluminum, bent and soldered corners.
 12. Spacer Color: Black.
 13. Edge Seal:
 - a. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.
 - b. Color: Black.
 14. Purge interpane space with dry air, hermetically sealed.
 15. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 - a. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - 1) Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 60 on #2 surface.
 - 2) Glass: Clear.
 - b. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
 - 1) Coating: No coating on inboard lite.
 - 2) Glass: Clear.
 16. Substitution Procedures: See Section 01 60 00 - Product Requirements.
 - a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.07 GLAZING UNITS

- A. Type GL-2 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.

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2. Glass Type: Annealed float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.
 5. Glazing Method: Dry glazing method, gasket glazing.
- B. Type GL-2T - 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. Other locations required by applicable federal, state, and local codes and regulations.
 - d. 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.

2.08 PLASTIC FILMS

- A. Type GF-1 - 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; Fasara, Frost: www.3m.com/windowfilm.
 - b. Avery Dennison; Design Window Films: www.averydennison.com/#sle.
 - c. Flexvue Films: www.flexvuefilms.com.
 - d. Llumar, an Eastman Chemical Company; Decorative Window Film, Llumar: www.llumar.com/#sle.
 - e. Madico, Inc: www.madico.com.
 - f. Solyx Films LLC: www.solyxfilms.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.

2.09 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.

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- B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; [_____] color.

2.10 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.

2.11 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide shop inspection and testing for Type GL-1 glass.

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.

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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)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

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.

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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.

3.08 SCHEDULES

- A. Aluminum-Framed Storefront Glazing: Glass Type GL-1, install glass using dry method, and with glass thickness as required to comply with performance requirements indicated in Section 08 43 13.

END OF SECTION

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**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.
 - 2. Carpet 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.

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: 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 F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

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F. 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. Visual Observation Report: For existing floor coverings to be removed.

B. 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.

C. 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. Include certification of accuracy by authorized official of testing agency.
- 7. Submit report to Architect.
- 8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. 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 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 District's project contact information.

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.

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- 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. 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.
- 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.

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2. Products:
 - a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
 - b. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
 - c. Floor Seal Technology, Inc; MES 100 with Floor Seal FloorCem SLU: www.floorseal.com/#sle.
 - d. Koster American Corporation; Koster VAP I 2000 with Koster SL Premium overlay: www.kosterusa.com/#sle.
 - e. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
 - f. LATICRETE International, Inc; LATICRETE SUPERCAP Moisture Vapor Control with LATICRETE SUPERCAP Underlayment: www.laticrete.com/#sle.
 - g. Maxxon Corporation; Maxxon MVP: www.maxxon.com/#sle.
 - h. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.
 - i. Themec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.
 - j. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Cementitious Patching Compound: 100-percent Portland cement-based self-leveling compound capable of providing adequate bond for subsequently applied floor adhesives; approved by remedial coating manufacturer.
 1. Products:
 - a. ARDEX Engineered Cements, Inc; ARDEX K-15: www.ardexamericas.com.
 - b. Mapei International; Mapei Ultraplan 1 Plus: www.mapei.com.
 - c. Sika Corporation; Sika Level-315: www.sikafloorusa.com.
 - d. 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.
 3. Preliminary cleaning.

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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 Recommended Work Practices for Removal of Resilient Floor Coverings, 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.

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- 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.

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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 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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**SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation.
- C. Gypsum sheathing.
- D. Cementitious backing board.
- E. Gypsum wallboard.
- F. 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 06 10 00 - Rough Carpentry: Building framing and sheathing.
- D. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- E. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- F. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- E. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
- F. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- I. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

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- J. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- K. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- L. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.
- M. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- N. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- R. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- S. ASTM E413 - Classification for Rating Sound Insulation.
- T. GA-216 - Application and Finishing of Gypsum Panel Products.
- U. GA-600 - Fire Resistance Design Manual Sound Control.
- V. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.
 - 1. 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. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.
- E. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing steel stud installation, gypsum board installation and finishing, with minimum five years of experience.
 - 1. Acceptable: Qualified in SFIA, "Contractor Certification Program".
- 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. Fire Resistance Rating:
 - 1. Certain partition constructions gypsum wallboard systems are required to meet fire resistive requirements of ASTM E119 and applicable building Codes.

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2. Construction which forms component parts of such assemblies shall be constructed to afford the fire resistance required by Code for the location and condition of construction indicated.
 3. See required ratings and designs on Drawings.
 4. Construction shall conform to requirements of these tested assemblies.
 5. Fire Resistive Gypsum Board: Material shall bear the Underwriters' Laboratories, Inc. (UL) label or label of other testing organization acceptable to the State Fire Marshal.
- D. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.06 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. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.
 1. CBC Chapter 7 Item Numbers: Comply with applicable requirements of CBC Chapter 7 Tables for the particular assembly; as indicated on Drawings.
 2. Gypsum Association Generic File Numbers: Comply with requirements of GA-600 for the particular assembly; as indicated on Drawings.
 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD); as indicated on Drawings.

2.02 BOARD MATERIALS

- A. General: Gypsum board, joint treatment and finishing materials shall be manufactured from asbestos-free materials.

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- B. Manufacturers - Gypsum-Based Board:
1. CertainTeed Corporation: www.certainteed.com/#sle.
 2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 3. National Gypsum Company: www.nationalgypsum.com/#sle.
 4. PABCO Gypsum: www.pabcogypsum.com/#sle.
 5. USG Corporation: 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.
 - b. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
 - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard: www.gpgypsum.com/#sle.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
 - f. PABCO Gypsum; MOLD CURB® PLUS Regular Mold and Moisture- Resistant Gypsum Board: www.pabcogypsum.com/#sle.
 - g. PABCO Gypsum; MOLD CURB® PLUS Type X Mold and Moisture- Resistant Gypsum Board: www.pabcogypsum.com/#sle.
 - h. USG Corporation; USG Sheetrock Brand EcoSmart Panels Mold Tough Firecode X: 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:

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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.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant: www.gpgypsum.com/#sle.
 - c. National Gypsum Company; Gold Bond Hi-Abuse XP Gypsum Board: www.nationalgypsum.com/#sle.
 - d. PABCO Gypsum; ABUSE CURB® Type X Gypsum Board: www.pabco gypsum.com/#sle.
 - e. USG Corporation; USG Sheetrock Brand Mold Tough AR Firecode X Panels: www.usg.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated, typical at sports activity rooms unless noted otherwise.
 - a. Provide up to 96 inches, minimum.
 2. Surface Abrasion: Level 3, 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 3, minimum, when tested in accordance with ASTM C1629/C1629M.

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5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 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 Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
 - b. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board: www.nationalgypsum.com/#sle.
 - c. PABCO Gypsum; PABCO® Impact Resistant Type X Gypsum Board: www.pabco gypsum.com/#sle.
 - d. USG Corporation; USG Sheetrock Brand Mold Tough VHI Firecode X Panels: www.usg.com/#sle.
- F. 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.
 - 2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 - 3) USG Corporation; Durock Cement Board Next Gen: www.usg.com.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- G. 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.

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- 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.
 - c. Lafarge North America Inc; Mold Defense Drywall.
 - d. National Gypsum Company; Gold Bond XP Gypsum Board:
www.nationalgypsum.com/#sle.
 - e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
 - 1. Application: Exterior sheathing, unless otherwise indicated.
 - a. Where plywood sheathing is not 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 Type X Exterior Sheathing:
www.certainteed.com/#sle.
 - b. CertainTeed Corporation; GlasRoc Brand.
 - c. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
 - d. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: www.gpgypsum.com/#sle.
 - e. National Gypsum Company; Gold Bond eXP Sheathing:
www.nationalgypsum.com/#sle.
 - f. USG Corporation: Securock Brand Glass Mat Sheathing.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 GYPSUM WALLBOARD 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.

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- 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.
 - b. CertainTeed; "NoiseReducer" Sound Attenuation Batts: 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. 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.
 - b. Fry Reglet: fryreglet.com.
 - c. Phillips Manufacturing Co: www.phillipsmfg.com.
 - d. Pittcon Industries: www.pittconinsutries.com
 - e. Trim-tex, Inc.: www.trim-tex.com.
 - f. CEMCO Products, Inc; www.cemco.com.
 - g. USG Corporation: 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.
 - 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) Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

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- D. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch length, applied to bottom edge of gypsum board.
 - 1. Height: 1/2 inch.
 - 2. Depth: 1/2 inch.
 - 3. Products:
 - a. Waterguard USA; Waterguard: www.waterguard-usa.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. 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.
- F. High Build Drywall Surfacers: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- G. Abuse Resistant Finishes:
 - 1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.
- H. Nails for Attachment to Wood Members: ASTM C514, as required for fire-resistive construction.
- I. Staples For Attachment of Base Ply of Two-Ply Assembly to Wood Members: Flattened galvanized wire type as specified in ASTM C840.
- J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- K. Adhesive for Attachment to Wood ASTM C557:
- 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.

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- 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 construction attaches to or abuts, including the following.
 - 1. Preset hollow metal frames
 - 2. Piping.
 - 3. Conduit.
 - 4. 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 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.

3.03 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.

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- 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 wood framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- I. 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.
- J. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority.
 - 1. Single-Layer Applications: Adhesive application.
 - 2. Double-Layer Application: Install base layer using screws or nails. Install face layer using adhesive.

3.04 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.

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- D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- E. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.05 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.

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3.06 TOLERANCES

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

3.07 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

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**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 06 10 00 - Rough Carpentry: Sheathing on exterior walls.
- B. Section 07 25 00 - Weather Barriers: Weather barrier under exterior plaster and stucco.
- C. Section 08 31 00 - Access Doors and Panels: Product requirements for metal access panels integral with metal lath.
- D. Section 09 21 16 - Gypsum Board Assemblies: Sheathing on exterior walls.
- E. Section 09 24 00 - Cement Plastering.

1.03 REFERENCE STANDARDS

- A. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring.
- D. ASTM C847 - Standard Specification for Metal Lath.
- E. 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.
- F. 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.
- 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. 2019 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.

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- 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: All products listed are "or equal".
 1. Brand X Metals: www.brandxmetals.com.
 2. CEMCO: www.cemcosteel.com/#sle.
 3. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com/#sle.
 4. Fry Reglet: www.fryreglet.com.
 5. Pittcon Industries: www.pittconindustries.com.
 6. Structa Wire Corporation; Structalath: www.structawire.com/#sle.
 7. 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.
- B. Fire Rated Assemblies: Provide components complying with requirements for fire rated assemblies specified in the section where the plaster finish is specified.

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.

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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. Corner Mesh: ASTM C1063; Formed sheet steel, minimum 0.018 inch thick, perforated flanges shaped to permit complete embedding in plaster, minimum 2 inch size; same finish as lath.
- D. Strip Mesh: Expanded metal lath, same weight as lath, 2 inch wide by 24 inch long; same finish as lath.
- 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, designation G60.
 - 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. Product: #66 Expanded Flange Casing Bead manufactured by Cemco.
 - b. Fabricated of 26 gage hot-dip galvanized steel. Provide beads with expanded metal flange and inverted vee at plaster edge of face flange.
 - 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.
 - 1) Product: No. 2-A Corner Bead manufactured by Cemco.
 - 2) Product: No. 2-A Reinforced Flange Corner Bead manufactured by Cemco.
 - b. 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.
 - 5. Base Screeds: Bevelled edges.

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- a. Foundation Weep Screeds: Perforated type.
 - 1) Product: No. 7 Foundation Sill Screed manufactured by Cemco.
 - 2) Product: No. 7 Extended Foundation Screed manufactured by Cemco. For locations where plaster is just above a paving surface.
- 6. Drip Screeds: Fabricated from 0.018 inch thick; G-90 hot-dip galvanized steel.
 - a. Product: #12 Soffit Drip Edge manufactured by Cemco.
 - b. Product: #6 Head Drip Screed manufactured by Cemco. For locations above other flashing such as door and window heads.
- 7. 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.
- 8. Soffit Vent:
 - a. Material: Extruded Aluminum ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.
 - b. Size: As indicated on Drawings.
 - c. Finish: Clear Anodized.
 - d. Product: Soffit Vent PCS-75-V-400 (example for 4 inch size with 3-coat plaster) manufactured by Fry Reglet.
- 9. 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.
- 10. 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.
- 11. Aluminum Accessories (Where Detailed):
 - a. Specified Manufacturer: Fry Reglet Corporation; www.fryreglet.com.
 - b. Acceptable Manufacturers:
 - 1) Interior Specialties Division, Gordon, Inc.; www.gordon-inc.com.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.
 - c. Do not allow base aluminum to contact cementitious materials.
 - d. Casing Beads: Fry Reglet, F-shaped aluminum, FPM-75-75, 3/4 inch reveal or Fry J-Molding JPM-75 as detailed.
 - e. Control Joints: Fry Reglet, Channel Screed, PCS-75-50, 1/2 inch wide reveal or as detailed on Drawings.
 - f. All intersections factory fabricated with joints heliarc welded and backs sealed with permanent waterproof tape. Provide connector clips and sealant at butt joints of

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- straight sections.
- g. Aluminum Finish:
 - 1) Clear anodized.
- h. Fasteners: 1-1/4 inch long S-12 pancake head, USG, Buildex Division of Illinois Tool Works or equal.

2.05 ACCESSORIES

- A. Access Panels: As specified in 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. At Vertical Surfaces:
 - a. Staples (for wood): 16 wire gage, 3/4 inch crown, 1-1/2 inch leg, chisel point.
 - b. Tie Wire: 18 gage.
 - 2. At Horizontal Surfaces:
 - a. Furring Nails: With 1/4 inch wad attached, 1-1/2 inch long, 11 gage electrogalvanized, 7/16 inch head, barbed.
 - 1) Roofing Nails: 2-1/2 inch barbed galvanized roofing nails with 7/16 inch head.
 - b. Staples (for wood): Zinc plated, 9 gage, ring shank, hook type, 3/4 inch crown, 2 inch leg.
 - c. Tie Wire: 18 gage, double strand.
- C. Fasteners: Self-piercing tapping screws; ASTM C1002 or ASTM C954.
 - 1. At Vertical Surfaces:
 - a. Screws: Self-drilling TEKS for metal stud attachment.
 - 2. At Horizontal Surfaces:
 - a. Screws: Self-drilling TEKS for metal stud attachment.
- D. 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.
 - 1. Do not allow the control or expansion joints to interrupt or be lapped with the weather barrier.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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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 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

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- 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. Lath shall not be continuous through control or expansion joints.
- C. 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 screw s.
- D. 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. Installation shall maintain lath 1/4 inch away from vertical supports.
- E. Attach metal lath to supports using screws at maximum 12 inches on center.
- F. Attach horizontal metal lath to metal supports using tie wire at maximum 6 inches on center vertical.
- G. 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.
- H. Place corner bead with mesh at external wall corners; fasten at outer edges of lath only.
- I. Place strip lath diagonally at corners of lathed openings. Secure rigidly in place.
- J. Place strip lath centered over junctions of dissimilar backing materials on same plane. Secure rigidly in place.
- K. 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.

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- L. Place 4 inch wide strips of lath centered over junctions of dissimilar backing materials, and secure rigidly in place.
- M. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
- N. 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..
- O. 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

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**SECTION 09 24 00
CEMENT PLASTERING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cement plastering. CPL-1 thru CPL-6

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers: Weather barrier under exterior plaster.
- B. Section 08 31 00 - Access Doors and Panels: Access panels.
- C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum Sheathing: Solid backing at all exterior plaster.
- D. Section 09 22 36 - Lath: Lath, furring, beads, screeds, and joint accessories for plaster base.
- E. Section 09 91 13 - Exterior Painting: Finish paint over intergral 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. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- F. CBC - California Building Code.
- G. 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. Evaluation Service Reports: Show compliance with specified requirements.
- D. 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.

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.

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1.06 MOCK-UP

- A. 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.
- B. 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. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119 and complying with the following:
 - 1. CBC, Section 2504.2.1 Wood furring strips (DSA & OSHPD 1& 4), 2510 Lathing and Plastering, 2511 Interior Plaster, and 2512 Exterior Plaster.
- B. 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. Manufacturers:
 - a. Dryvit; Commercial Cement Plaster (CCP) 4: www.dryvit.com.
 - b. LaHabra; FastWall 300: www.lahabrastucco.com/#sle.

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- c. Omega Products International, Inc.; Super Cement with Crack Isolation System: www.omega-products.com.
 - d. Parex USA, Inc; Armourwall 300: www.parexusa.com/#sle.
 - e. Sto Corp; Sto Powerwall: www.stocorp.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- C. 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.
 - D. Premixed Base Coats: Mixture of cement, aggregate, fibers, and proprietary admixtures for scratch and brown coats; install in accordance with ASTM C926.
 - E. Premixed Leveling Coat: Acrylic polymer-based blend approved for use with plaster manufacturer's base coat and finish materials.
 - 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.

2.03 ACCESSORIES

- A. Lath: As specified in Section 09 22 36.
- B. Beads, Screeds, and Joint Accessories: As specified in 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: As specified in 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.

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- 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.
 - d. Finish coat to match existing texture.
 - 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

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**SECTION 09 30 00
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications. T-1, T-7 G-1.
- B. Tile for wall applications. T-2 thru T-6 , G-2
- C. Cementitious backer board as tile substrate.
- D. Thresholds.
- E. Ceramic trim.

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 - Americans with Disabilities Act (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 - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland 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 or Latex-Portland 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 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland 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.

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- 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 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement 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 Installation.
- T. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- U. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile.
- V. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- W. ANSI/NFSI B101.3 - Test Method for Measuring Wet DCOF of Common Hard Surface Floor Materials.
- X. 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.
- Y. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- Z. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products.
- AA. CBC - California Building Code.
- BB. CBC Ch. 11B - California Building Code-Chapter 11B.
- CC. SCAQMD 1168 - Adhesive and Sealant Applications.
- DD. 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.

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1.05 SUBMITTALS

- A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.
- C. 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.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. 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.
- F. Installer's Qualification Statement:
- G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- H. Maintenance Materials: Furnish the following for District'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. 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.

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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, CBC Chapter 11B and ADA Standards, latest amendment.
 - 1. Tile flooring surface shall be stable, firm, and slip resistant. CBC Ch. 11B 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 Ch. 11B 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.
 - 2. Dal-Tile Corporation: 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): As indicated on drawings.

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6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
- C. Quarry Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: Over 3.0 but not more than 5.0 percent as tested in accordance with ASTM C373.
 2. Size: As indicated on Drawings, nominal.
 3. Thickness: 1/2 inch, nominal.
 4. Edges: Cushioned.
 5. Surface Finish: Non-slip.
 - a. Dynamic Wet Slip Resistance DCOF AcuTest: 0.42
 6. Color(s): As indicated on drawings.
 7. Trim Units: Matching bullnose, cove, cove base, and window sill or step nosing shapes in sizes coordinated with field tile.
- D. Porcelain Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 2. Size: as indicated on Drawings, nominal.
 3. Edges: Cushioned.
 4. Surface Finish: Non-slip.
 - a. Dynamic Wet Slip Resistance DCOF AcuTest: 0.42
 5. Color(s): To be selected by Architect from manufacturer's standard range.
 6. Trim Units: Matching bullnose, double bullnose, cove base, and cove 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. 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.

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- c. Manufacturers:
 - 1) Formica Corporation Product: Signatures: www.formica.com.
 - 2) Avonite Surfaces Product Avonite: www.avonitesurfaces.com.
 - 3) Dupont Product: Corian: www.corian.com.
 - 4) Panolam Industries International, Inc.(Nevamar); Product Fountainhead: www.nevamar.com.
 - 5) Wilsonart International, Inc Product: Gibraltar: www.wilsonart.com.
- 3. Color and Pattern: As indicated on drawings.
- 4. Applications:
 - a. At doorways where tile terminates.

2.04 SETTING MATERIALS

- A. 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.
- B. Manufacturers:
 - 1. Custom Building Products: www.custombuildingproducts.com/#sle.
 - 2. LATICRETE International, Inc: www.laticrete.com/#sle.
 - 3. Mapei Corporation: www.mapei.com.
 - 4. Merkrete, by Parex USA, Inc: www.merkrete.com/#sle.
- C. 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.
 - b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.
 - c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
- D. 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.
 - b. Custom Building Products; ReliaBond Ceramic Tile Adhesive - Type 1: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE 15 Premium Mastic: www.laticrete.com/#sle.
 - d. MAPEI Corporation; Type 1: www.mapei.com.
 - e. Merkrete, by Parex USA, Inc; Merkrete Merstik: www.merkrete.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.

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2.05 GROUTS

- A. Manufacturers:
1. Basis of Design: Custom Building Products: www.custombuildingproducts.com/#sle.
 2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 3. Bonsal American, Inc; ProSpec Sanded Tile Grout 700: www.prospec.com
 4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 5. MAPEI Corporation: www.mapei.com.
 6. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/#sle.
- B. 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.
 - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - c. Mapei, Inc.; Keracolor S Grout unsanded: www.mapei.com
 - d. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
 - e. TEC, an H.B. Fuller Construction Products Brand; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
- C. 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.
 - b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
 - c. MAPEI Corporation; Kerapoxy Epoxy Grout: www.mapei.com.
 - d. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
 - e. TEC, an H.B. Fuller Construction Products Brand; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com/#sle.
- D. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.

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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.
 - b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
 - c. MAPEI Corporation; Mapesil Silicone Sealant: www.mapei.com.
 - d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com/#sle.
- 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; local representative Dale Roberts (951) 255-0243.
 - b. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/#sle.
- 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.
 - b. STONETECH, a division of LATICRETE international, Inc; STONETECH Heavy Duty Stone Sealer: 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.

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:

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- 1) Custom Building Products; Custom 9240 Waterproofing and Anti-Fracture Membrane: www.custombuildingproducts.com.
 - 2) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - 3) MAPEI Corporation; Mapelastic HPG w/Fiberglass Mesh: www.mapei.com.
 - 4) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
 - 5) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
- 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.
 - 2) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 3) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 4) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: www.merkrete.com/#sle.
- C. Membrane at Walls:
1. Material: No. 15 asphalt saturated felt.
- D. 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.
- E. 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.

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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.

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- 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 thresholds where indicated.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. 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 - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

3.07 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.

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- 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.

3.08 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

3.09 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.

3.10 GROUT SEALER

- A. Clean grout and apply sealer in accordance with manufacturer's instructions and recommendations.

3.11 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.

3.12 CLEANING

- A. Clean tile and grout surfaces.

3.13 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

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**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units; ACT-1, ACT-2, ACT-3

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. Section 08 31 00 - Access Doors and Panels: Access panels.
- D. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC) - Air Outlets and Inlets: Air diffusion devices in ceiling.
- E. Division 26 - Electrical - Interior Lighting: Light fixtures in ceiling system.
- F. 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 the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- F. CHPS (HPPD) - High Performance Products Database.
- G. 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.

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- 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 District'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.

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.
 - a. Local contacts Dai-Nee Tan 949-275-8169 or Tim Traber 760-473-1108.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. USG Corporation: www.usg.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

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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. CBC Section 1617A.1.21.
 - 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, Section 1616A.1.21; CBC Title 24 Part 2, Chapter 25.
 - a. Include the following Interpretation of Regulations, issued by the Division of the State Architect (DSA).
 - 1) IR A-5: Acceptance of Products, Materials, and Evaluation Reports.
 - 2) IR 16-9: Pendant Luminaires; Revised 9/14/20.
 - 3) IR 25-2-19: Suspended Lay-In Panel Ceiling; Revised 3/18/22.
 - 4) IR 25-1: Maximum Allowable Load for Ceiling Wires; Revised 7/1/20.

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: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - a. Form: 2, water felted.
 - b. Pattern: "C" - perforated, small holes.
 - 2. Size: 24 by 48 inch.
 - 3. Thickness: 3/4 inch.
 - 4. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range: 0.55, determined in accordance with ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 7. Panel Edge: Square.
 - 8. Weight: 0.70 lbs per SF.

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- 9. Suspension System: Exposed grid.
 - 10. Basis of Design Product: School Zone Fine Fissured No. 1729 as manufactured by Armstrong World Industries, or equal.
- D. Acoustical Panels, Type ACT-2: Mineral fiber with scrubbable finish, with the following characteristics:
- 1. Classification: ASTM E1264 Type IX.
 - a. Form: 2, water felted.
 - b. Pattern: "G" - smooth.
 - 2. Size: 24 by 48 inch.
 - 3. Thickness: 5/8 inches.
 - 4. Light Reflectance: 89 percent, determined in accordance with ASTM E1264.
 - 5. Ceiling Attenuation Class (CAC): 33, determined in accordance with ASTM E1264.
 - 6. Panel Edge: Square.
 - 7. Weight: 0.67 lbs per SF.
 - 8. Suspension System Type TBAR-1: Exposed grid.
 - 9. Basis of Design Product: Kitchen Zone as manufactured by Armstrong World Industries, or equal.
- E. Acoustical Panels, Type ACP-1: Glass fiber with membrane-faced overlay, with the following characteristics:
- 1. Classification: ASTM E1264 Type XII.
 - a. Form: 2, cloth.
 - b. Pattern: "E" - lightly textured.
 - 2. Size: 48 by 48 inches.
 - 3. Thickness: 1 inch.
 - 4. Light Reflectance: 90 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range: 0.95, determined in accordance with ASTM E1264.
 - 6. Articulation Class (AC): 190, determined in accordance with ASTM E1264.
 - 7. Panel Edge: Square.
 - 8. Tile Edge: Square.
 - 9. Color: White.
 - 10. Weight: 0.50 lbs per SF.
 - 11. Suspension System Type TBAR-1: Exposed.
 - 12. Basis of Design Product: Optima, No. 3160 as manufactured by Armstrong World Industries, 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

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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.
 4. Finish: Baked enamel.
 5. Color: White, unless noted otherwise.
 6. Basis of Design Product: Prelude XL 7301 main runners; FastSize; XL7341, XL7340, XL7342, and XL7328 cross runners - ICC ESR 1308 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, 0.08 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.
 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
- F. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
 1. Trim Height: 6 inch.
 2. Finish: Baked enamel.
 3. Color: White.
 4. Basis of Design Product: Axiom as manufactured by Armstrong World Industries, or equal.
- 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.

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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.
 - 1. Conform to DSA IR 25-2.13 Metal Suspension Systems for Lay-In Panel Ceilings.
- 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. 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.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- H. 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 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

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- B. Coordination of Other Tests and Inspections: District will employ independent testing agency to test and/or inspect anchors; provide access and assistance as required to accommodate timely performance.
- C. Testing (per DSA IR 25-2.13): All field testing must be performed in the presence of the project inspector or a special inspector.
 - 1. New Installations:
 - a. Post-installed anchors in concrete used to support hanger wires shall be tested at a frequency of 10 percent.
 - 1) Power actuated fasteners in concrete shall be field tested for 200 lbs. in tension. All other post-installed anchors in concrete shall be tested in accordance with CBC Section 1910A.5.
 - b. Post-installed anchors in concrete used to attach bracing wires shall be tested at a frequency of 50 percent in accordance with CBC Section 1910A.5.
 - 2. Re-Use of Existing Ceiling Hanger Wires and Bracing Wires:
 - a. All existing ceiling hanger wire/anchor assemblies must be tested to 200 lbs.
 - b. All existing bracing wire/anchor assemblies must be field tested to 440 lbs.
 - c. Where a new wire is spliced to an existing wire, each spliced wire/anchor assembly must be field tested to the loads given for existing assemblies above.

3.06 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.

3.07 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

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**SECTION 09 65 00
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring. LVT-1, LVT-2
- B. Resilient base.
- 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.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
- C. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- D. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
- E. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
- F. ASTM F1861 - Standard Specification for Resilient Wall Base.
- G. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.
- H. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers.

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.

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- 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 District'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.

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.

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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.
- 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. 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. CalGreen 5.504.4.6.3.
 - d. Products certified under UL GreenGuard Gold; www.greenguard.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 - Type LVT-1: Printed film type, with transparent or translucent wear layer.
 1. Manufacturers:
 - a. Armstrong Flooring Inc; Biome: www.armstrong.com/#sle.
 - b. Shaw Contract: www.shawcontract.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 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. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329; certified in accordance with UL 2824.
 5. VOC Content Limits: As specified in Section 01 61 16.
 6. Total Thickness: 0.125 inch.
 7. Color: As indicated on drawings.
- B. (LVT) Luxury Vinyl Tile - Type LVT-2: Printed film type, with transparent or translucent wear layer.

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1. Manufacturers:
 - a. Armstrong Flooring Inc; Natural Creations with Diamond 10 Technology Matiz: www.armstrong.com/#sle.
 - b. Shaw Contract: www.shawcontract.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
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. Total Thickness: 0.125 inch.
7. Color: As indicated on drawings.

2.04 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset Type TS rubber, vulcanized thermoset; style as scheduled ; style as scheduled.
 1. Manufacturers:
 - a. Armstrong; Wall Base: www.armstrongflooring.com.
 - b. Burke Flooring: www.burkeflooring.com/#sle.
 - c. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - d. Roppe Corporation; Contours Profiled Wall Base System: 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 inch.
 4. Thickness: 0.125 inch.
 5. Finish: Satin.
 6. Length: Roll.
 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.

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- 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 District.
- 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.

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- 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 District'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.

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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

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**SECTION 09 65 66
RESILIENT ATHLETIC FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rubber sheet flooring, adhesively installed. RF-1, RF-2, RF-3, RF-4.

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 flooring.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- D. Section 09 65 00 - Resilient Flooring.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- C. DIN EN 14904 - Surfaces for Sports Areas – Indoor Surfaces for Multi-Sports Use – Specification.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; request attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 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, and layout, colors, and widths of game lines and equipment locations.
- D. Selection Samples: Manufacturer's color charts for flooring materials specified , indicating full range of colors and textures available.
- E. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.
- F. Test Reports: Submit test reports showing compliance with DIN EN 14904.
- G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- H. Manufacturer's Instructions: Indicate standard and special installation procedures.
- I. Installer's qualification statement.

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- J. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
- K. Maintenance Materials: Furnish the following for District'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 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 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 in unopened containers clearly labeled with manufacturer's name and identification of contents.
- C. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.08 FIELD CONDITIONS

- A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 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 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.
- 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 :

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- a. SCS Floorscore; 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. CalGreen 5.504.4.6.3.
- d. Products certified under UL GreenGuard Gold; www.greenguard.org. CalGreen 5.504.4.6.4.

2.02 PREFORMED ATHLETIC FLOORING

- A. Rubber Sheet Flooring: Two-layer vulcanized rubber.
 - 1. VOC Content: As specified in Section 01 61 16.
 - 2. Thickness: Minimum 3/8 inch.
 - 3. Sheet Width: Minimum 73 inches.
 - 4. Durometer Hardness, Type A: Minimum of 80, when tested in accordance with ASTM D2240.
 - 5. Surface Texture: Smooth.
 - 6. RF-1, RF-2, RF-3, RF-4, Color: As indicated on drawings.
 - 7. Basis of Design Product: Sport Impact 10MM as manufactured by Mondo, USA, www.mondoworldwide.com, or approved equal.

2.03 ACCESSORIES

- A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- B. Beveled Edging: Black rubber transition ramp edging as available from flooring manufacturer.
- C. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. 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 athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

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1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.
- C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.
- D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions and approved shop drawings.
- C. Resilient Sheet Flooring:
 1. Unroll flooring and allow to relax before beginning installation.
 2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
 3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
 4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
 5. Weld seams using techniques and equipment recommended by manufacturer.
 6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
 7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

3.04 CLEANING

- A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

- A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

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**SECTION 09 67 00
FLUID-APPLIED FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and base. EPOXY-1.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Grounding and bonding of conductive flooring to building grounding system.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ANSI/ESD STM7.1 - The Protection of Electrostatic Discharge Susceptible Items Flooring Systems Resistive Characterization.
- C. CBC Ch. 11B - California Building Code-Chapter 11B.
- D. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

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 and colors available.
- C. Samples: Submit two samples, 8 by 8 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
- F. Manufacturer's Qualification Statement.
- G. Applicator's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

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- 2. Extra Top Coat Materials: 2 gallons.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum three years of documented experience.
 - 2. Approved by manufacturer.
- C. Supervisor Qualifications: Trained by product manufacturer.

1.06 MOCK-UP

- A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - 1. Number of Mock-Ups to be Prepared: One.
 - 2. Use same materials and methods for use in the work.
 - 3. Use approved design samples as basis for mock-ups.
 - 4. Locate where directed.
 - 5. Minimum Size: 48 inches by 48 inches.
- B. Obtain approval of mock-up by Architect before proceeding with work.
- C. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. All products used Must comply with 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 ADA Standards, latest amendment.

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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.

2.02 MANUFACTURERS

- A. Basis of Design Product: StonClad UT as manufactured by StonHard, or approved equal.
- B. Fluid-Applied Flooring:
 1. Concrete Solutions by Rhino Linings: www.concretesolutions.com.
 2. Crossfield Products Corp: www.crossfieldproducts.com/#sle.
 3. Elite Crete Systems: www.elitecrete.com/#sle.
 4. DUR-A-FLEX. Inc.; Dur-A-Quartz: www.dur-a-flex.com.
 5. Sherwin-Williams Company; Armorseal 100% Solids Epoxy/Polyurethane: www.protective.sherwin-williams.com.
 6. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com.
 7. Stonhard, an RPM Company: www.stonhard.com.
 8. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring Type EPOXY-1: Polyurethane mortar base coat(s) with broadcast aggregate.
 1. Aggregate: Vinyl flakes.
 2. System Thickness: 1/4 inch, nominal, dry film thickness (DFT).
 3. Texture: Slip resistant.
 4. Sheen: High gloss.
 5. Color: As selected by Architect.
 6. Basis of Design Product: Stonshield UT as manufactured by Stonhard, or approved equal.

2.04 ACCESSORIES

- A. Fillet Strips: Molded of flooring resin material.
- B. Copper Grounding Strips: Type and size as recommended by fluid-applied flooring manufacturer.
- C. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- D. Primer: Type recommended by fluid-applied flooring manufacturer.

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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 flooring.
- 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 flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied 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 fluid-applied flooring manufacturer.
 - 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Prepare concrete surfaces according to ICRI 310.2R, CSP 3.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.
- E. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

- A. Install access panel recess frames.
- B. Install fillet strips at base of walls where flooring is to be extended up wall as base.
- C. Install copper grounding strips in accordance with flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.

3.04 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Cove at vertical surfaces.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

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B. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.06 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION

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SECTION 09 72 16
ARCHITECTURAL VINYL GRAPHIC FILMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural Decorative Film. GF-2
- B. Graphic artwork cut pattern.

1.02 RELATED REQUIREMENTS

- A. Section 06 20 00 - Finish Carpentry.
- B. Section 08 11 13 - Hollow Metal Doors and Frames.
- C. Section 08 80 00 - Glazing.
- D. Section 09 21 16 - Gypsum Board Assemblies.
- E. Section 09 91 23 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

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. Product Data: Provide manufacturer's data sheets on each product to be used and adhesive.
- C. Shop Drawings:
 - 1. Submit shop drawings covering fabrication, installation and finish of specified systems.
 - 2. Include fully dimensioned plans and elevations with material coordination keys.
 - 3. Show artwork for each film item.
- D. Samples:
 - 1. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
 - 2. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Specimen Warranty: Submit manufacturer's standard warranty document by authorized manufacturer.

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- H. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces, including precautions against harmful cleaning materials and methods.

1.06 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 the work of this section and approved by manufacturer.
 - 1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
 - 2. Provide a commercial building reference list of five (5) properties where the installer has applied film. This list will include the following information:
 - a. Name of building.
 - b. The name and telephone number of a management contact.
 - c. Type of substrate.
 - d. Type of film.
 - e. Amount of film installed.
 - f. Date of completion.
- C. Single-Source Responsibility: For each separate film graphic type required from one source of a single manufacturer.
- D. Graphic fabricator is responsible for the quality and materials and workmanship required for the execution of this contract including the materials and workmanship of any firms or individuals who act as his sub-contractors.
- E. Create artwork for specific items as noted on Drawings meet design intent; including final artwork for fabrication (including reproducible film positives).
- F. The graphic design requirements shown by the details Drawings show design intent only and intended to establish basic dimensions colors, shapes, profiles, sight lines, and appearance. Maintain visual design concept as shown, including sizes, shapes, colors, and placement as accurately as possible.

1.07 MOCK-UP

- A. Provide film mock-up, one complete area, illustrating installation for evaluation of surface preparation techniques and application workmanship.
- B. Locate where directed.
- C. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
- D. Refinish mock-up area as required to produce acceptable work.
- E. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

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- B. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.
- C. Product must remain in original plastic bag and boxes and have storage conditions as follows:
 1. 40°F (5°C) - 90°F (32°C) storage temperature range
 2. Out of Sunlight
 3. Clean dry area
 4. Original container
 5. Do not stack boxes over six (6) units high. Excessive weight can damage the film
 6. Products are not recommended for interior applications where condensation consistently occurs.
 7. Handle products in accordance with manufacturer's instructions.
 8. Total pre-installation shelf life: 2 years. Up to 2 years unprocessed, OR process within 1 year and apply within 1 year of processing.

1.09 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.
- B. Environmental Limitations: Do not install until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
 1. Apply materials when environmental conditions are continuously heated. Application temperature range is 60°F - 100°F (16°C - 38°C).
- D. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

1.10 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 warranty for appearance and adhesion properties.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Vinyl Graphic Wall Coverings: 3M Company - Commercial Solutions Division [CSD]; : 1-888-650-3497.

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- B. Other Acceptable Manufacturers - Wall Coverings:
 1. Graffiti Inc.: www.graffitiinc.com.
 2. Flexvue Films: www.flexvuefilms.com.
 3. Madico, Inc: www.madico.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.03 MATERIALS

- A. General: Printed and textured graphic film for factory or field applied application.
 1. Graphic film and overlaminate for inkjet printing with solvent, UV, latex inks and screen printing. For field applied application.
 - a. Graphics: Artwork provided by District.
- B. Film: Image printed on vinyl; 2 mil thickness with luster finish.
- C. Decorative Pattern: Printed graphic image to be provided through the Architect.
- D. Adhesive: Acrylic, Pressure Sensitive.

2.04 FABRICATION

- A. Conform shop fabrication and tolerances for graphic artwork to the standards of the industry.
- B. Shop fabricated all item, so far as practicable.
- C. Perform high-quality, professional workmanship.
- D. Fabricate work to proper proportions, with orientation that will be straight, plumb, level and square and to sizes, shapes and profiles indicated on the approved shop drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify pattern prior to material acquisition.
- B. Verify that substrate surfaces are in compliance with requirements for non-porous, smooth surface, ready to receive work, and conform to requirements of the wall covering manufacturer.
 1. Responsibility for state of surfaces prior to installation to be pre-determined by an installation specialist.
 2. Reference Manufacturer's Technical Data Sheet to determine compatibility of finish to substrate
 3. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by film and adhesive manufacturer.

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- 4. 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.
- C. Do not proceed with work until conditions have been corrected.
- D. Proceeding with installation implies installer’s acceptance of substrate and conditions.

3.02 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.
 - 1. Ensure that the existing paint, surface finish, or wall covering has excellent bond to the substrate area where Product will be applied.
- C. Thoroughly clean substrate of substances that could impair the overlay’s bond, including mold, mildew, oil, grease.
- D. Re-clean surfaces with appropriate surface prep solvent and remove any haze or surface contamination.
- E. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- F. Test and prepare application surfaces per manufacturer's instructions.
 - 1. Use the manufacturer's adhesion test to determine the compatibility of the application surface.
 - 2. Use the 3M™ Enhanced Cleaning Method to ensure that the application surface is ready to receive and hold the Product.

3.03 INSTALLATION

- A. Do not proceed with installation until all finishing work has been completed in and around the work area.
- B. Environmental Limitations: Do not install until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Install in accordance with manufacturer's instructions.
- D. Application must be performed by qualified installer.
- E. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- F. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- G. Apply smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tightly.

3.04 CLEANING

- A. Use cleaning methods recommended by manufacturer for applicable environment.
- B. Clean film of excess adhesive, dust, dirt, and other contaminants.

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- C. After application of film, wash film using common cleaning solutions, including ammonia solutions, 30 days after application.
 - 1. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film.
 - 2. Use synthetic sponges or soft cloths.
- D. Reinstall wall plates and accessories removed prior to work of this section.
- E. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
- F. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 PROTECTION

- A. Protect completed graphic film during remainder of construction period.
- B. Do not permit construction activities at or near finished areas.

END OF SECTION

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**SECTION 09 91 13
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. 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.
- D. 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. Brick, Architectural concrete, and Cast stone.
 - 9. Glass.
 - 10. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

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.

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- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- D. SCAQMD 1113 - Architectural Coatings.
- E. SSPC-SP 1 - Solvent 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 District'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

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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.
 - a. Local representative Jan Piccola 714.679.5730.
 - 2. Dunn-Edwards Corporation: www.dunnedwards.com,
 - a. Local representative Wanda Barragan 909.261.1289.
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - a. Local representative John Dumesnil 619.665.9341.
 - 5. Vista Paint: www.vistapaint.com.
 - a. Local representative Mark Brower 323.397.9000.

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- 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. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.
- 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. 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.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units and primed metal.
 - 1. One or two coats to cover and one coat primer.
 - 2. Top Coat(s): Exterior Latex.

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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. Exterior Plaster, Opaque, 100% Acrylic Latex, 3 Coat:
1. One coat of latex primer sealer.
 2. Flat: Two coats of latex.
- C. Ferrous Metals, Unprimed, Latex, 3 Coat:
1. See Section 09 96 00 - High-Performance Coatings.
 2. One coat of latex primer.
- D. Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 2. See Section 09 96 00 - High-Performance Coatings.
- E. Ferrous Metals, Unprimed, High-Performance, 3 Coat:
1. See Section 09 96 00 - High-Performance Coatings.
 2. Pre-Treatment: As recommended by manufacturer
 3. One coat galvanize primer.

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. Interior/Exterior Latex Block Filler.
 3. Anti-Corrosive Alkyd Primer for Metal.
 4. Interior/Exterior Quick Dry Alkyd Primer for Metal.
 5. Alkyd Primer for Galvanized Metal.
 6. Water Based Primer for Galvanized Metal.
 7. Rust-Inhibitive Water Based Primer.
 8. Interior/Exterior Quick Dry Primer for Aluminum.
 9. 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.

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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 effect 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 Plaster and Stucco: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

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. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
 - 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- H. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. 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.
- J. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.

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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.

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.
- 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.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- G. Sand 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.

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

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**SECTION 09 91 23
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. 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. 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.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, to match face panels.
- D. 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.
- B. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. SCAQMD 1113 - Architectural Coatings.

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- C. SSPC-SP 1 - Solvent Cleaning.
- D. SSPC-SP 2 - Hand Tool Cleaning.
- E. SSPC-SP 6 - Commercial Blast Cleaning.
- F. SSPC-SP 13 - Surface Preparation of Concrete.

1.04 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 definitely not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. 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.
- F. Maintenance Materials: Furnish the following for District'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.

1.05 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 and with minimum three years experience.

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1.06 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.

1.07 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 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. 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. Paints:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - a. Local representative Jan Piccola (714) 679-5730.
 - 2. Dunn-Edwards Corporation: www.dunnedwards.com,
 - a. Local representative Wanda Barragan (909) 261-1289.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - a. Local representative John Dumesnil (619) 665-9341.
 - 4. Vista Paint; www.vistapaint.com .
 - a. Local representative Mark Brower (323) 397-9000.
- C. Primer Sealers: Same manufacturer as top coats.

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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. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.
- 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. 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 they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and shop primed steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Latex.
 - 3. Top Coat Sheen:

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- a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Medium duty applications include doors and door frames.
 - 2. Two top coats and one coat primer.
- 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. Top Coat(s): Interior Light Industrial Coating, Water Based.
- 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. Aluminum, Unprimed, Latex, 3 Coat:
 - 1. One coat etching primer.

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/Exterior Quick Dry Primer for Aluminum.
 - 9. Interior Alkyd Enamel Undercoat.
 - 10. Stain Blocking Primer.
 - 11. Stain Blocking Primer, Water Based.

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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 effect 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. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.

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.
 - 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.
- E. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

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- 2. Prepare surface according to SSPC-SP 2.
 - 3. Solvent clean according to SSPC-SP 1.
 - 4. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- H. 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.
- 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. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. 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

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**SECTION 09 96 00
HIGH-PERFORMANCE COATINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High performance coatings.
 - 1. Exterior Steel: exterior steel, hollow metal doors and frames, and metal copings/flashings (not prefinished)
 - 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.

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 D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
- D. ASTM D4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- F. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.
- G. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- H. SCAQMD 1113 - Architectural Coatings.
- I. SSPC-SP 1 - Solvent 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.

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- 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 District'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.

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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-up.
- B. Locate where directed.
- C. 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.

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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. Carboline: www.carboline.com.
 2. Dunn Edwards : www.dunnedwards.com.
 3. PPG Paints: www.ppgpaints.com/#sle.
 - a. Local representative Susan L. Giampietro 949.410.2452.
 4. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries/#sle.
 - a. Local Representative: John Dumesnil, 619.665.9341.
 5. Tnemec Company, Inc: www.tnemec.com/#sle.
 - a. Local Representative: Tony Hobbs, 310.637.2363.
 6. 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. Scrubbability: Excellent, when tested in accordance with ASTM D2486.
 4. 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: See Section 01 61 16.
 4. 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.

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- 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.
 - 5. Colors: As indicated.
- B. Epoxy Coating:
- 1. Number of coats: Two.
 - 2. Product Characteristics:
 - a. Comply with the performance requirements specified above for moderate exposure.
 - 3. Top Coat(s): High Performance Institutional, Two-Component, Water Based Epoxy Coating; MPI #252, #254, #255, #256.
 - a. Trash Enclosure:
 - b. Sheen: Semi-Gloss.
 - c. Products:
 - 1) PPG Paints; Aquapon WB EP Two-Component Waterborne Epoxy, 98E-1/98E-100 Series, Semi-Gloss: www.ppgpaints.com/#sle.
 - 2) Rust-Oleum Corporation; Water-Based Epoxy Maintenance Coating - S60: www.rustoleum.com/#sle.
 - 3) Sherwin-Williams; Pro Industrial Water Based Catalyzed Epoxy: www.protective.sherwin-williams.com/#sle. (MPI #254)
 - 4) Substitutions: Section 01 60 00 - Product Requirements.
- C. Urethane Coating:
- 1. Exterior Steel: 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.
 - 2) Dunn Edwards; Endura-Coat ENCT60: www.dunnedwards.com.
 - 3) Benjamin Moore; Ultra Spec HP D.T.M. Acrylic Gloss HP28: www.benjaminmoore.com.
 - 4) Tnemec Company, Inc; Series 1080 Endurashield: www.tnemec.com/#sle.

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- 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. Block Filler, Epoxy.
 - a. Products:
 - 1) PPG Paints; Amerlock 400 Epoxy Block Filler, 400BF: www.ppgpaints.com/#sle.
 - 2) Substitutions: Section 01 60 00 - Product Requirements.
 - 2. Rust-Inhibitive, Water Based; MPI #107.
 - a. Products:
 - 1) Benjamin Moore; Ultra Spec HP Acrylic Metal Primer HP04: www.benjaminmoore.com.
 - 2) Dunn Edwards; EnduraPrime ENPR00: www.dunnedwards.com.
 - 3) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer: www.protective.sherwin-williams.com/#sle. (MPI #107)
 - 4) Tnemec Company, Inc; Series 115 Uni-Bond DF: 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. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

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1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
- H. Masonry: Verify masonry joints are struck flush.
- I. 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. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by coating manufacturer.
 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- E. 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.
- F. 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 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.
- G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils.

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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. District will provide field inspection.
- C. Dry Film Thickness Testing: District 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

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**SECTION 09 96 23
GRAFFITI-RESISTANT COATINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Graffiti-Resistant Coatings applied to exterior plaster/stucco and concrete surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 07 92 00 - Joint Sealants.
- D. Section 09 24 00 - Cement Plastering.

1.03 REFERENCE STANDARDS

- A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and District.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
- D. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.
- E. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Graffiti-Resistant Coating Material: Five gallons of the type installed.
 - 3. Cleaner: Provide 5 one gallon containers of manufacturer's specified cleaner only for applied areas under 5,000 square feet, and 10 one gallon containers for applied areas over 5,000 square feet.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

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- B. Installer Qualifications: Company specializing in performing the work of this section approved by manufacturer.
- C. District reserves the right to provide continuous independent inspection of surface preparation and application of graffiti-resistant coating.

1.07 MOCK-UP

- A. Prepare a representative surface 36 by 36 inch in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.
 - 1. Allow sample area to cure and attack with indelible makers and spray paint.
 - 2. Installer to notify Architect, Contractor, Owner Representative, and manufacturer 72 hours prior to a cleaning demonstration.
- B. For proposed substitutions, prepare side-by-side mock-ups of specified and substitute products.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in unopened packaging until ready for installation.
 - 1. Container labeling to include manufacturer’s name, type of coating brand name, brand code, coverage, surface preparation, cure time, cleanup, and instructions for mixing.
- B. Store components under a dry covered area and elevated above grade.
- C. Store materials in well ventilated area, no less than 45°F and no more than 90°F, unless otherwise allowed by manufacturer.

1.09 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply graffiti-resistant coating when ambient temperature is lower than 50 degrees F or higher than 90 degrees F.
- C. Do not apply graffiti-resistant coatings when wind velocity is higher than 10 mph.
- D. Do not apply coatings during rain, or if rain is imminent within 48 hours.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty for labor.
- D. Provide ten year manufacturer warranty for materials.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acrylic Graffiti-Resistant Coatings (Non-Sacrificial):
 - 1. MonoPole Inc.; Permashield Base (Sealer) with Premium 5600 (low-Luster): www.monopoleinc.com.
 - 2. Coval Molecular Coatings; Coval Anti-Graffiti Coat: covalmolecular.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fluorosilane Graffiti-Resistant Coatings:
 - 1. Chemical Products Industries, Inc.; StainGuard-WB: www.chemicalproductsokc.com.
 - 2. Evonik Degussa Corporation; Protectosil® Anti-Graffiti: www.protectosil.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Silane/Siloxane Graffiti-Resistant Coatings:
 - 1. Sherwin-Williams Company; Anti-Graffiti Coating: www.sherwin-williams.com.
 - 2. PROSOCO, Inc.; Blok-Guard® & Grafti Control Ultra 15: www.prosoco.com.
 - 3. Ranguard Products Co.; VandlGuard Ten (2 coats) and VandlGuard Finish Coat, Non-Sacrificial; www.rainguard.com.
 - 4. SEI Chemical; SCS-002SP Sealer and GPA-300 Graffiti Proofer (Non-Sacrificial): www.seichemical.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Exact product to be used will be determined by side-by-side mock-up testing of at least 3 products meeting specified requirements; prepare mock ups as specified above; submit cost breakdown for each product used in mock-up, including both unit and total costs.
- B. Graffiti-Resistant Coating: Non-sacrificial, non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing, that dries invisibly leaving appearance of substrate unchanged.
 - 1. Applications: All applicable vertical surfaces up to 12 feet above finish grade and non-traffic horizontal surfaces.
 - 2. Minimum Number of Coats: Two.
 - 3. VOC Content: As specified in Section 01 6116.
 - 4. Moisture Absorption When Applied to Masonry: 5 percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with graffiti-resistant coating.
 - 5. Maintains dry appearance when wetted.
 - 6. Products (or equal): Water-based acrylic
 - a. Monopole, Inc.; Permanent Graffiti Control:
 - 1) Permashield Base 6100.

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- 2) Permashield Premium 5600 (Top Coat - Matte Finish).
- 3) Cleaner: Citrus Clean Super - 9800
- b. Substitutions: See Section 01 60 00 - Product Requirements.
- 7. Compatibility: Anti-Graffiti coating shall be compatible with all standard paintable polymer type caulking and sealing materials and certified by manufacturer as suitable for use.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of graffiti-resistant coating.

3.02 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive graffiti-resistant coating.
- B. Prepare surfaces to be coated as recommended by graffiti-resistant coating manufacturer for best results.
 - 1. Graffiti-Resistant coating over paint.
 - a. Primer as recommended by manufacturer of coating. Paint cure time as recommended by paint manufacturer prior to coating.
 - 2. Graffiti-Resistant coating over unsealed concrete, brick, stucco, stone or block masonry units.
 - a. Provide compatible water repellent sealer as indicated in Section 07 19 00 - Water Repellents, as recommended by manufacturer.
 - 3. Graffiti-Resistant coating over substrates or finishes not mentioned above.
 - a. Consult manufacturer for recommendations.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove oil and foreign substances with a chemical solvent that will not affect graffiti-resistant coating.
- E. Allow surfaces to dry completely to degree recommended by graffiti-resistant coating manufacturer before starting coating work.

3.03 APPLICATION

- A. Apply at rate recommended by manufacturer, continuously over entire surface.
- B. Apply two coats, minimum.

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- C. Remove graffiti-resistant coating from unintended surfaces immediately by a method instructed by graffiti-resistant coating manufacturer.
- D. Provide manufacturer's field service representative to inspect preparation and application work continuously during entire application period to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION

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**SECTION 10 11 00
VISUAL DISPLAY UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Porcelain enamel steel markerboards.
- B. Tackable wall panels TWP-1, TWP-2

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 - Architectural Wood Casework: Sliding markerboards integrated with casework.
- B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard.
- B. ANSI A208.1 - American National Standard for Particleboard.
- C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling.
- D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on chalkboard and chalkboard.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- D. Samples: Submit color charts for selection of color and texture of 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. 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.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. A-1 Visual Systems Co.: www.a-1visualsystems.com.
- B. ADP Lemco, Inc: www.adplemco.com/#sle.
- C. Chatfield-Clarke: www.chafield-clarke.com.
- D. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
- E. MooreCo, Inc: www.moorecoinc.com/#sle.
- F. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.
- G. Polyvision Corporation: www.polyvision.com/#sle.
- H. US Markerboard: www.usmarkerboard.com.
- I. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY UNITS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
 - 1. Color: White.
 - 2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch .
 - 3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
 - 4. Backing: Aluminum foil, laminated to core.
 - 5. Size: As indicated on drawings.
 - 6. Frame: Extruded aluminum, with concealed fasteners.
 - 7. Frame Profile: As indicated on drawings.
 - 8. Frame Finish: Anodized, natural.
 - 9. Accessories: Provide marker tray and map rail.
- B. Tackable Wall Panels: Fabric laminated to fiberboard; Factory-fabricated.
 - 1. Fabric: Vinyl coated fabric.
 - 2. Color, Pattern, and Texture: As indicated on drawings.
 - 3. Backing: Fiber board, 1/2 inch thick, laminated to tack surface.
 - 4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
 - 5. Panel Width: 48 inches.
 - 6. Height: Full height of room or wall; No horizontal seams.
 - 7. Edge Treatment: Square edge unless detailed otherwise.
 - 8. Edge Molding: Provide metal "J-mold" type edge trim for exposed edges at door and window openings and similar conditions.
 - 9. Adhesives: Provide manufacturer's recommended adhesive, primer, and sealer, produced for use on substrate shown on drawings. Provide materials which are mildew-

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resistant and non staining to wallcovering.

10. Manufacturers:

- a. A-1 Visual Systems Co.: www.a-1visualsystems.com.
- b. ABC School Equipment: www.abcse.com.
- c. ADP Lemco, Inc: www.adplemco.com/#sle.
- d. Chatfield-Clarke; Vinyl Tackboard Panels: www.chafield-clarke.com.
- e. Claridge Products and Equipment, Inc; 3400 Series:
www.claridgeproducts.com/#sle.
- f. MooreCo, Inc: www.moorecoinc.com/#sle.
- g. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.
- h. Substitutions: See Section 01 60 00 - Product Requirements.

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.

2.03 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Vinyl Coated Fabric: ASTM F793 Category VI.
- C. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).
- D. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.
- E. Fiber Board: ASTM C208, cellulosic fiber board.
- F. Foil Backing: Aluminum foil sheet, 0.005 inch thick.
- G. Steel Sheet Backing: Manufacturer's standard thickness, galvanized , galvanized.
- H. Adhesives: Type used by manufacturer.

2.04 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. Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, bracketed to fit top rail of board.
- D. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.
- E. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, manufacturer's standard fastening method, same finish as frame.

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- F. Mounting Brackets: Concealed.
- G. Factory printed grid lines for music rooms.

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.
- C. Verify flat wall surface for frameless adhesive-applied boards.

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 and wall switches.
- 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 about 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.

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C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

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**SECTION 10 14 00
SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs. SIGN-1 & SIGN-2
- B. Emergency evacuation maps.

1.02 RELATED REQUIREMENTS

- A. Section 10 14 53 - Traffic and Parking Signage: Fire lane, accessibility and traffic signage.

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 - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

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 sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from District through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by District through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Maintenance Materials: Furnish the following for District's use in maintenance of project.

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1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

1.06 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 tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs:
 1. ASI Sign Systems, Inc.: www.asisignage.com.
 2. Best Sign Systems, Inc: www.bestsigns.com.
 3. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com/#sle.
 4. Cosco Industries (non-ADA signs): www.coscoarchitecturalsigns.com/#sle.
 5. FASTSIGNS: www.fastsigns.com/#sle.
 6. Inpro: www.inprocorp.com/#sle.
 7. Mohawk Sign Systems, Inc: www.mohawksign.com.
 8. Quiel Signs: www.quielsigns.com
 9. Seton Identification Products: www.seton.com/aec.
 10. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific 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.
 2. Raised characters shall comply with CBC 11B-703.2.

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- 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 Section 11B-703.2.5
- c. Finish and contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1
- d. Proportions: It shall be selected from fonts where the width of the uppercase letter "O" is 60 % minimum and 110 % maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15% maximum of the height of the character. CBC Sections 11B-703.2.4 and 11B-703.2.6.
- e. Character Spacing: Spacing between individual tactile characters shall comply with CBC Section 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 11B-703.2.9.
- g. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed and rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
- 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 Section and Figure 11B-703.4.1.
- i. Mounting location: A tactile sign shall be located per CBC Section 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.
- j. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40 inches minimum above finish floor or ground.
- k. Pictograms shall comply with CBC Section 11B-703.6.
- l. Symbol of accessibility shall comply with CBC Section 11B-703. 7.
- m. Variable message signs shall comply with CBC Section 11B-703.8.

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- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
1. Sign Type: Flat signs with injection molded or etched panel media as specified.
 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 3. Character Height: 1 inch.
 4. Sign Height: 3 inches, unless otherwise indicated.
 5. Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings.
 6. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 7. 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 Sections 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 Section 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 11B-216.8.1 at the entrances to toilet and bathing rooms.
 - 2) Comply with CBC 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: 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.
 - (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.
 8. Exits: Provide raised character and Braille exit signs per CBC Section 1013.4 at the following locations:

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<u>Location</u>	<u>Text</u>
Grade level exit door	EXIT

- C. Emergency Evacuation Maps:
 - 1. Allow for one map per building.
 - 2. Map content to be provided by District.
 - 3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

2.03 SIGN TYPES

- 1. Wall Mounting of One-Sided Signs: Tape adhesive.
 - a. Provide visually matching back plate when mounted on a glass surface.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: As scheduled.
 - 4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved or photopolymer etched through face to expose core as background color:
 - 1. Interior Basis of Design Product: InTouch™ ADA-Ready™ Sign System with requirements indicated for materials, thickness, finish colors, designs, shapes, sizes and details as manufactured by ASI Sign Systems, Inc., or approved equal.
 - 2. Total Thickness: 1/8 inch, matte finished acrylic.
 - 3. Fabrication:
 - a. Tactile Graphics and Text:
 - 1) Fabrication process: Provide tactile copy and grade 2 Braille raised 1/32 inch minimum from plaque first surface by manufacturer’s photopolymer bonded process. Sign face of single material, tactile characters and Braille integral to photopolymer. Adhesive-fixed characters are not acceptable.
 - 2) Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors. Tactile characters to be raised min. 1/32 inch from surface. Computerized translation of sign copy to be responsibility of the manufacturer.
 - b. Letter style[s], color[s], letter size[s] and layout position:
 - 1) As selected by Architect from manufacturer’s standard letter style and color charts.
 - c. Text Schedule: As indicated on Drawings.

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- d. Tactile Lettering and Graphics Color Options: As selected by Architect from manufacturer's standard colors.
 - e. Mounting Panel Options:
 - 1) Size:
 - (a) Same size.
 - f. Background Appearance Options:
 - 1) Solid color[s]: As selected by Architect from manufacturer's standard colors.
 - 2) Subsurface custom graphics.
 - g. Overall panel size: As indicated on Drawings.
 - h. Shape: As indicated on Drawings.
- B. Etched Metal Panels: Zinc based panel etched through face to expose core as background color:
- 1. Exterior Basis of Design Product: SignEtch™ ADA-Ready™ Sign System with requirements indicated for materials, thickness, finish colors, designs, shapes, sizes and details as manufactured by ASI Sign Systems, Inc., or approved equal.
 - 2. Total Thickness: 1/8 inch.
 - 3. Paint: Primer and urethane based color coat, of type standard with manufacturer.
 - a. U.V. resistant clear urethane top coat required for exterior applications.
 - 4. Fabrication:
 - a. Tactile Graphics and Text:
 - 1) Fabrication process: Provide tactile copy and grade 2 Braille raised 1/32 inch minimum from plaque first surface by manufacturer's photochemical etching.
 - 2) Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors.
 - b. Letter style[s], color[s], letter size[s] and layout position:
 - 1) As selected by Architect from manufacturer's standard letter style and color charts.
 - c. Raised text and graphic finishes:
 - 1) Colors/Sheen:
 - (a) As selected by Architect from manufacturer's standard colors.
 - (b) Finish: Matte.
 - d. Text Schedule: As indicated on Drawings.
 - e. Edge Detail: Square.
 - f. Edge Finish: Brushed.
 - g. Overall panel size: As indicated on Drawings.
 - h. Recessed Graphics Color Options:
 - 1) As selected by Architect from manufacturer's standard colors.

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- i. Recessed Area Texture Options:
 - 1) Smooth paint.

2.05 NON-TACTILE SIGNAGE MEDIA

- A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
 - 1. Sign Color: Clear.
 - 2. Total Thickness: 1/8 inch.

2.06 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material.
- C. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material.
- D. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- E. Exposed Screws: Stainless steel.
 - 1. Exposed fasteners are permitted only where specifically indicated, and shall be tamper proof stainless steel, countersunk, and may be painted or finished to match adjacent surfaces.
- F. Tape Adhesive: Double sided tape, permanent adhesive.
- G. Adhesives:
 - 1. Type recommended by the manufacturer of the material specified to be laminated or adhered.
 - 2. No adhesives that fade, discolor or delaminate as a result of proximity to sunlight or heat therefrom shall be used.
 - 3. Adhesives shall not change the color or otherwise deteriorate the materials to which they are to be applied.
 - 4. The adhesives shall be of non-staining, non-yellowing quality.
- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Do not start work until deficiencies have been corrected. Start of work of this section constitutes acceptance of the surfaces.

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3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mounting Method:
 - 1. Mount signs to surfaces with a minimum of four countersunk tamperproof stainless steel fasteners.
 - 2. Provide anchorage where necessary for fastening signs securely in place.
 - a. Anchorage not otherwise specified or indicated shall include expansion shields and power-driven fasteners;
 - 1) when approved:
 - (a) for concrete and masonry;
 - (b) toggle or molly bolts to plaster surfaces;
 - (c) full threaded wood screws to wood doors;
 - (d) machine or metal screws to metal doors.
 - b. Provide backing plates for mounting to expanded metal substrates.
 - 3. Adhere signs to glass with adhesive.
 - C. Install neatly, with horizontal edges level.
 - D. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and CBC Chapter 11B.
 - 1. Room and Door Signs: Locate on wall at latch side of door a minimum of 48 inches to the baseline of the lowest braille cells; with top of highest line of raised character text at maximum 60 inches above finished floor.
 - a. Comply with CBC 11B-703.4.1
 - E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.03 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.

3.04 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

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**SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments. TP-1
- B. Urinal screens.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- B. Section 10 28 00 - Toilet Accessories.

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 - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. California Building Code (CBC) chapter 11B, disabled accessibility regulations.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. CBC - California Building Code.
- G. CBC Ch. 11B - California Building Code-Chapter 11B.
- H. 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.
 - 1. If other than specified manufacturer or specified product, submit catalog data.
- 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.

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- D. Samples: Submit two samples of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 WARRANTY

- A. All components shall have a 15 year limited warranty.

1.07 PACKAGING, DELIVERY, STORAGE AND HANDLING

- A. Packaging: Maintain factory packaging and protective coverings.
- B. Storage: Store panels to prevent impact and moisture damage.

1.08 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.

1.09 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.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Code compliance of these systems must be verified prior to use. They may be no longer available and are not yet proven to be compliant with NFPA 286, per CBC Sections **803.1.2**, **803.11**, 2604.2.4.
- 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 Americans with Disabilities Act (ADA Standards) Accessibility Guidelines, 36 CFR 1191.
- C. California Building Code (CBC) disabled accessibility regulations.
 - 1. Wheelchair accessible compartment shall comply with CBC Ch. 11B-604.8.1.
 - 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Figure 11B-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.

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- 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 Section 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 MANUFACTURERS

- A. Plastic Toilet Partitions:
 - 1. Basis of Design Product: Hiny Hiders Partitions as manufactured by Scranton Products, or approved equal.
 - 2. Scranton Products; Hiny Hiders Partitions: www.scrantonproducts.com/#sle.
 - 3. Substitutions: Section 01 60 00 - Product Requirements.

2.03 PLASTIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286, floor-mounted headrail-braced.
 - 1. Color: Single color as selected.
- B. Flame Spread Rating (ASTM E84):
 - 1. Class B flame spread 26-75 and smoke developed of 0-450.
- C. Doors:
 - 1. Thickness: 1 inch.
 - 2. Width: 24 inch.
 - 3. Width for Accessible Use: 36 inch, out-swinging.
 - 4. Comply with CBC Section 11B-604.8.1.2.
 - 5. Height: 55 inch.
- D. Panels:
 - 1. Thickness: 1 inch.
 - 2. Height: 55 inch.
 - 3. Depth: As indicated on drawings.

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- E. Pilasters:
 - 1. Thickness: 1 inch.
 - 2. Width: As required to fit space; minimum 3 inch.
- F. Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets .
 - 1. Urinal Screens: Wall mounted with continuous panel brackets.
 - a. Height: 42 inches, mounted 14 inches above floor
 - b. Depth: 24 inches.

2.04 FABRICATION

- A. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required.

2.05 ACCESSORIES

- A. Do not furnish chrome plated, non-ferrous cast alloy material for hinges, brackets, locks, latches and all fittings and accessories.
- B. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with satin finish, 4 inch high, concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
 - a. Provide 3/8 inch threaded rod, spring washer and locking nut attached to 4 inch expansion anchors embedded in the concrete floor
 - 2. Size: Manufacturer's standard size.
 - 3. Fit over tops of pilasters and at headrail brackets with one way sex bolts.
- C. Wall and Pilaster Brackets: Stainless steel; continuous type.
- 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. Hinges: Stainless steel, manufacturer's standard finish.
 - 1. Continuous-type hinge, self closing.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 - 1. Door Latch: Slide type with exterior emergency access feature.
 - a. Configuration: Surface mounted and through bolted to door with one way sex bolts
 - b. Material: Cast stainless steel.
 - c. SS Door Latch Basis of Design Product: ADA Slide Bolt Latch & Keeper SS, Manufacturer part # 6049, 1002927 as manufactured by Bobrick, or approved equal.
 - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
 - a. Configuration: Wrap around flange surface mounted and through bolted to pilaster with one way sex bolts

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- b. Material: Cast stainless steel.
 - c. Strikes: 6 inches long.
 - d. Door bumper to accommodate projection of all door hardware and toilet accessories.
 - e. Inswing Keeper Basis of Design Product: Hiny Hider Aluminum 6" Inswing Strike And Keeper For 1" Post as manufactured by Scranton Products, or approved equal.
 - f. Outswing Keeper Basis of Design Product: Hiny Hider Aluminum 6" Outswing Keeper Bumper For 1" as manufactured by Scranton Products, or approved equal.
3. Provide ADA compliant door pull for swinging doors.
- a. Surface mounted U-shaped or wire pulls on both sides of accessible compartment doors.
 - b. Chrome Plated Double Door Pull 5-1/2", for 1 inch thick doors.
 - c. Overall width is 6-3/4 inches with 5-7/8 inch hole spacing.
 - d. Basis of Design Product: Double Door Pull 5-1/2" Stainless Steel part # 610112 as manufactured by Hadrian, or approved equal.
- G. Coat Hook: One per compartment, mounted on door.
- 1. Mount such that no portion is over 47 inches above finish floor.
- H. Fasteners, General:
- 1. Concrete Anchors: Stainless steel expansion or self-threading, as specified in Section 050519 - Post-Installed Concrete Anchors. Lead expansion shields are not acceptable.
 - 2. Fasteners:
 - a. Provide stainless steel, vandal resistant fasteners throughout, one-way upset head.
 - b. Molly-type fasteners, chrome plated zamac, toggle bolts and other hollow wall anchors are not acceptable.
 - c. See general requirements for fasteners specified in Section 05 50 00 - Metal Fabrications.
 - 3. Concealed Fasteners: Galvanized steel or stainless steel.
 - 4. Exposed Fasteners: Stainless steel.
 - 5. Panel-to-Panel Fasteners: Use thru-bolted attachments at panels, doors and pilasters with sex nut bolts through clamp flanges.
 - 6. Metal Framing Anchors: Use self-tapping metal screws through wall finish into metal framing or backing sheets.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examination: 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.

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3.02 EXAMINATION

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

3.03 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 050519 - Post-Installed Concrete Anchors.
 - 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.
 - 1. Provide clearances of not more than 1/2 inch between pilasters and panels.
 - 2. Secure panels to pilasters with continuous brackets located to align with continuous brackets at wall.
- E. Floor Anchors: Set pilaster units with anchorage as specified herein. Level, plumb, and tighten installation for durable installation.
- F. Field touch-up of scratches or damaged finish are not permitted. Replace damaged or scratched materials with new materials.

3.04 TOLERANCES

- A. Alignment Tolerance: Plus or minus 1/16 inch, in any direction.

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- B. Maximum Variation From True Position: 1/4 inch, except at required dimensions at accessible spaces.
- C. Maximum Variation From Plumb: 1/8 inch.

3.05 ADJUSTING

- A. Operation: Doors shall operate smoothly and evenly.
- B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
 - 1. Hang doors and adjust so that tops of doors are parallel with overhead brace when doors are in closed position.
- C. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
 - 1. Adjust doors to remain open at approximately 30 degrees.
- D. Adjust adjacent components for consistency of line or plane.
- E. Field Operation and Alignment Check: Demonstrate compliance with specified tolerance and operation requirements.
 - 1. Should check reveal misalignment, improper operation or inadequate anchorage, realign, adjust and re-anchor the entire installation to Architect's satisfaction.
 - 2. Replace deformed, marred, damaged or dented parts at no change in Contract Time or Sum.

3.06 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

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**SECTION 10 26 00
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards. WP-1

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.
- B. 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. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 24 inches long.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for District's use in maintenance of project:
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
- G. 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.

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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.
 - 2. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 3. Inpro: www.inprocorp.com/#sle.
 - 4. Koroseal Interior Products: www.koroseal.com/#sle.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
 - 6. Trim-Tex, Inc: 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.

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2.03 PRODUCT TYPES

- A. WP-1Corner 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 06 10 00 for wood blocking for wall and corner guard anchors.
- E. 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.

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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

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**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 06 10 00 - Rough Carpentry: Concealed supports, included in wall framing and plates.
- B. Section 10 21 13.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- F. ASTM C1036 - Standard Specification for Flat Glass.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.
- H. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

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.

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- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.
- D. Maintenance Materials: Furnish the following for District'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, and 2010 ADA Standards, as amended.
- B. Accessible requirements:
 - 1. Elements of sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
 - 2. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609.
 - 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 highest 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 11B-609.3.
 - 5. Toilet tissue dispensers are to be continuous flow type. CBC Section 11B-604.7.
 - 6. All other accessories shall not project more than 4 inches from wall surface, but cannot encroach into any required clear space.

2.02 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. ASI - American Specialties, Inc: www.americanspecialties.com.
 - 2. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
 - 3. Bradley Corporation: www.bradleycorp.com.
 - 4. Gamco: www.gamcousa.com.
 - 5. Georgia-Pacific Professional: www.blue-connect.com.
 - 6. Substitutions: Section 01 60 00 - Product Requirements.

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- 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. Adhesive: Two component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Stainless steel except where fully concealed may be hot dip galvanized; tamper-proof; security type.
- G. 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, surface mounted bracket type, chrome-plated zinc alloy brackets, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
 - 1. Basis of Design Product: B-2888 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- B. Toilet Paper Dispenser: Double roll, semi-recessed, stainless steel unit with pivot hinge.
 - 1. Basis of Design Product: B-3888 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- C. Toilet Paper Dispenser: Double roll, recessed, stainless steel unit, tumbler lock.
 - 1. Basis of Design Product: B-35883 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- D. Combinations Toilet Paper Dispenser and Sanitary Napkin Disposal Unit:
 - 1. Toilet Paper Dispenser: Double roll, recessed, stainless steel unit.
 - 2. Sanitary Napkin Disposal Unit: Stainless steel, recessed, self-closing door, locking bottom panel with removable receptacle.
 - 3. Basis of Design Product: B-3094 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.

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1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 2. Size: 24 by 36 inches.
 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
 5. Basis of Design Product: B-165.2436 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: 1-1/2 and 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed 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.
 - 1) Minimum Length for Side Wall of Water Closet: 48 inches.
 - 2) Minimum Length for Rear Wall of Water Closet: 42 inches.
 - e. Basis of Design Product at Student Restrooms: Snap Flange B-5806 Series as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
 - f. Basis of Design Product at Staff Restrooms: Snap Flange B-5806 Series as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.
- G. Clothes Hook and Bumper: Satin stainless steel clothes hook.
1. Mounting: Concealed wall plate.
 2. Basis of Design Product: B-2116 as manufactured by Bobrick Washroom Equipment, Inc., or approved equal.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
 2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
 3. Construction: 1/8 inch flexible PVC.
 - a. 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. Comply with ASTM C1822, type indicated.
 - c. Comply with ASME A112.18.9.
 - d. Microbial and Fungal Resistance: Comply with ASTM G21.

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4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
6. Products:
 - a. Bobrick Washroom Equipment, Inc.; www.bobrick.com.
 - b. Bradley Corporation : www.bradleycorp.com.
 - c. IPS Corporation Lav Guard 2 Undersink Pipe Covers: www.ipscorp.com.
 - d. IPS Corporation TrueBro Lav Shield: www.ipscorp.com.
 - e. Plumberex Specialty Products, Inc; Plumberex Pro-Extreme: www.plumberex.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
 1. Holders: Three spring-loaded rubber cam holders.
 2. Length: 36 inches.
- B. 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.

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. See Section 06 10 00 for 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.

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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 maximum , measured 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. Clothes Bumper/Coat Hook: 40 to 48 inches. CBC 11B-603.4 Coat hooks, shelves and medicine cabinets
 5. Other Accessories: As indicated on drawings.

3.04 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

3.05 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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**SECTION 10 44 00
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire blankets.
 - 1. At kitchens with open flame.
- C. Fire extinguisher cabinets.
- D. Emergency Access Key Boxes
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- B. Fire Extinguishers Standard: California Fire Code (CFC) section 906.
- C. Title 19 California Code of Regulations.
- D. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- F. CBC - California Building Code.
- G. CBC Ch. 11B - California Building Code-Chapter 11B.
- H. NFPA 10 - Standard for Portable Fire Extinguishers.
- I. UL 300 - Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment.

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.

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- 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 Standards, and Title 19 CCR.
 - 1. Fire Extinguisher cabinets must comply with CBC Ch. 11B-305 Clear floor or ground space, 11B-307 Protruding Objects, CBC Ch. 11B-308 Reach Ranges, CBC Ch. 11B-309/811.4 Operable Parts, CBC Ch. 11B-403 Walking Surfaces, CBC Ch. 11B-811.3 Height.
 - 2. Comply with CBC Ch. 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 Ch. 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, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcp.com/#sle.
 - 2. Amerex; www.amerex-fire.com.
 - 3. Ansul, Inc. Sentry: www.ansul.com.
 - 4. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 5. Larsen's Manufacturing Co; Model No. MP5: www.larsensmfg.com.
 - 6. Nystrom, Inc: www.nystrom.com/sle.
 - 7. Potter-Roemer: Model No. 300S: www.potterroemer.com/#sle.
 - 8. Pyro-Chem, a Tyco Business: 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.activarcp.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 3. Larsen's Manufacturing Co: www.larsensmfg.com.

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4. Nystrom, Inc: www.nystrom.com.
5. Potter-Roemer: www.potterroemer.com/#sle.
6. Strike First Corporation of America: 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: 20B:C.
 3. Size: 10 pound.
 4. Size and classification as scheduled.
 5. Finish: Baked polyester powder coat color as selected.
- C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
 1. Comply with CGA V-5 and CFC section 904.12.5.
 2. Class: K type.
 3. Size: 1.6 gallons.
 4. Size and classification as scheduled.
 5. Finish: Polished stainless steel.
 6. Temperature range: 32 degrees F to 120 degrees F.

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; 6 inch stud: Cosmopolitan Stainless Steel FE Cabinet Recessed 1035V17LDVRFE Flat Trim as manufactured by Activar, or approved equal.
 4. Basis of Design Product; 4 inch stud: Cosmopolitan Stainless Steel FE Cabinet Semi-Recessed 1036V17LDVRFE 1-1/2" Square Trim as manufactured by Activar, or approved equal.
 5. Basis of Design Product; 3-1/2 inch stud: Cosmopolitan Stainless Steel FE Cabinet Semi-Recessed 1037V17LDVRFE 3" Rolled Trim as manufactured by Activar, or approved equal.

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- 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-LDVRFE 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-LDVRFE 3" Rolled Trim as manufactured by Activar, or approved equal.
- D. Cabinet Configuration: Semi-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. Trim: Flat square edge, with 13-7/8 inch wide face.
 - 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.

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- 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: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- I. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- J. Fabrication: 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 EMERGENCY ACCESS KEY BOXES

- A. Fire Department Lock Box: Heavy-duty, mounting according to application, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
 - 1. Capacity: Holds 10 keys.
 - 2. Finish: Manufacturer's standard finish as selected by Architect.
 - 3. Products:
 - a. Knox Company; Knox-Box Rapid Entry System: www.knoxbox.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 4. Recessed at Buildings or Site Walls:
 - a. Lock boxes shall be mounted to the left or right of the main entrance door/gate and as indicated on the Drawings.
 - b. Knox box at buildings shall be mounted 6 feet from top of box to finished grade, or at a location and height approved by the Fire Department.
 - c. Products:
 - 1) Knox Company; Model 3227.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements. Only if allowed or required by local Fire Department.
 - 5. The Knox Fire Department alert decals shall be provided on all exterior doors of the facility and on all interior doors that keys have been furnished for within the lock box.
 - a. If the building/facility is protected with a fire alarm system or burglar alarm system, the lock boxes shall be "tamper" monitoring.
 - b. The tamper monitoring must include the following:
 - 1) All central stations shall be UL listed.
 - 2) For combination Fire/Burglar Alarm Panels, the Knox Box monitoring shall be through the fire side of the panel.

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- (a) For buildings with only burglar alarm systems, the Knox Box tamper monitoring shall be on a separate 24 hour, instant, non-shuntable burglar alarm zone.
 - 3) Central stations upon receiving a Knox Box tamper alarm signal shall:
 - (a) Notify and respond to local Police Department (Knox Box tamper).
 - (b) Notify and respond to the local Fire Department (Knox Box tamper).
- B. Manufacturer: Knox Company, Irvine, California, to match existing system.
- C. For single story buildings, use Model 3200 or 4400. For multi-story buildings, use Model 1220 or 1300. If box is exposed to weather, use Model 1200-WH. Verify selection with local fire department.

2.06 ACCESSORIES

- A. Fire Blanket: Fire retardant treated wool; red, 62 by 84 inch size.
 - 1. Provide at locations where an open flame may occur, such as science rooms, CTE programs, and kitchens. (Per Education Code)
- B. 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.
- C. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

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.

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2. Place cabinet to position the extinguisher handle at maximum 48 inches AFF.
 3. Place Cabinet maximum 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 metal studs or framing with sheet metal screws
 3. 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 District.

3.03 MAINTENANCE










- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide a separate maintenance contract for specified maintenance service.

3.04 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
 - a. Comply with CFC 906.4 for spacing and quantity.
 - 1) Maximum 30 feet from cooking device ("hazard").
- C. General Use: 1 Dry Chemical Type 2A-10BC, 10 lb. capacity, baked enamel finish extinguisher; Cabinet recessed mounting.
- D. Classroom Use: 1 Dry Chemical Type 2A-20BC, 10 lb. capacity, baked enamel finish extinguisher; Cabinet recessed mounting.
- E. Kitchen: 1 fire blanket, 1 Dry Chemical Type 1A:K, 1.6 Gallon (6 liter) capacity, stainless steel finish extinguisher placed in specified cabinet.

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3.05 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

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**SECTION 10 51 13
METAL LOCKERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers. LK-1

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking and nailers.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (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.
- C. CBC Ch. 11B - California Building Code-Chapter 11B.

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 District's name and register with manufacturer.

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- C. Installer Warranty: Provide 2-year warranty for workmanship, excluding the finish and vandalism commencing on the Date of Final Inspection. Complete forms in District'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 District'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 Ch. 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 Ch. 11B-811.
 - 2. Provide latch and locking hardware that does not require twisting, pinching, or grasping to operate. CBC Ch. 11B-309.4.
 - 3. Provide shelf and pole at 48 inches maximum AFF and lower shelf at 15 inches minimum AFF. CBC Ch. 11B-308 and 811.3

2.02 MANUFACTURERS

- A. Metal Lockers:
 - 1. DeBourgh Manufacturing Co; Core Series Lockers: www.debourgh.com/#sle.
 - 2. List Industries, Inc: www.listindustries.com/#sle.
 - 3. Lyon Workspace Products: www.lyonworkspace.com/#sle.
 - 4. Penco Products, Inc: www.pencoproducts.com/#sle.
 - 5. Republic Storage Systems Co: www.republicstorage.com/#sle.
 - 6. Salsbury Industries: 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. Width: 15 inches.
 - 2. Depth: 15 inches.
 - 3. Height: 72 inches.
 - 4. Configuration: Two tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - a. Hat shelf.
 - b. Single shoe shelf.

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- c. Coat rod.
- d. Hooks: One single prong.
- 6. Ventilation: Louvers at top and bottom of door panel.
- 7. 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.
- 8. Provide sloped top.
- 9. 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.

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- 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 Ch. 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.

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.

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- 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. Bolt at four points, two at top and two at bottom, using 1/4 inch cadmium plated 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

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**SECTION 10 56 13
METAL STORAGE SHELVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Case type shelving.
- B. Shelving accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and reinforcement in walls for anchoring shelving units.
- B. Section 09 21 16 - Gypsum Board Assemblies: Blocking and reinforcement in walls for anchoring shelving units.
- C. Section 10 56 23 - Wire Storage Assemblies Installation of wire storage shelving on mobile carriages.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

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. Rated uniform shelf loads.
 - 2. Details of shelving assemblies, including reinforcement.
 - 3. Accessories.
 - 4. Installation methods.
 - 5. Specimen warranty.
 - 6. Maintenance methods.
- C. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.
- D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.
 - 1. Indicate methods of achieving specified anchoring requirements.
- E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for District's use in maintenance of project.

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1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Shelves: Two of each size with shelf brackets.

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 performing the work of this section with minimum two years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect for dents, scratches, or other damage. Replace damaged units.
- B. Store in manufacturer's unopened packaging until ready for installation.
- C. Store under cover and elevated above grade.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Case Type Shelving:
 1. List Industries, Inc; Case Shelving: www.listindustries.com/#sle.
 2. Penco Products, Inc: www.pencoproducts.com/#sle.
 3. SpaceSaver Corporation: www.spacesaver.com/#sle.
 4. Tenssco Storage; Q-Line Shelving: www.tenssco.com/#sle.
 5. Wenger Corp.: www.wenger.com.
 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SHELVING - GENERAL

- A. See drawings for layout and sizes.
- B. Seismic Design: Design for Seismic Zone 4, in accordance with ASCE 7, Section 9.
- C. Anchors: Provide anchoring hardware to secure each shelving unit to floor and wall.
 1. Provide hardware of type recommended by manufacturer for substrate.
 2. See drawings for additional details of anchorage.

2.03 CASE TYPE SHELVING AND CABINETS

- A. Case Type Shelving: Steel, closed sides, with shelving brackets, shelving surfaces, and accessories as specified.

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1. Unit Width: 36 inches, overall.
 2. Shelf Capacity: Uniform distributed load of 50 psf, minimum.
 3. Shelf Deflection: 1/4 inch in 36 inches, maximum, under specified uniform load.
 4. Adjustability of Shelving: At intervals of 6 inches on center.
 5. Shelf Depth: 17-1/2 inches, minimum.
 6. Unit Depth: Not more than 1/4 inch greater than shelf depth.
 7. Shelves per Unit: As indicated on drawings.
 8. Finish: Baked enamel, medium gloss.
 9. Color: As selected by Architect from manufacturer's standard range.
 10. Provide single-face and double-face units where indicated.
 11. Number of Units: As indicated on drawings.
- B. Case Construction: Formed sheet metal comprising vertical support members and enclosure panels.
1. Shelf Support Members: 16 gauge, 0.0598 inch, minimum; manufacturer's standard profile.
 2. Face Width of Exposed Vertical Supports: 2 inches, maximum.
 3. Panels: 24 gauge, 0.0239 inch, minimum.
 4. Provide panels at intermediate divisions as well as ends and backs.
 5. Provide canopy tops of same construction as shelves.
 6. Connecting Hardware: Manufacturer's standard.
 7. Post Bases: Flat steel foot plate , with manufacturer's recommended adjustable leveling device.
- C. Shelves: Formed sheet metal, finished on all surfaces.
1. Thickness: 16 gauge, 0.0598 inch, minimum.
 2. Shelf Edge Profile: Extending 3/4 inch, maximum, below top surface of shelf.
 3. Shelf Connection to Posts: Manufacturer's standard.

2.04 ACCESSORIES

- A. Kick Plates: Formed sheet metal; enclose open space between bottom shelf and floor on all front sides and open ends; finished to match.
- B. Drawers: Formed steel, with mounting brackets and earthquake stops.
1. Width: 11-1/4 inch.
 2. Height: 4-5/8 inch.
 3. Depth: Shelf depth.
 4. Finish: Manufacturer's standard.
- C. Shelf Partitions: Steel, full height.
1. Height: 3 inches.

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- 2. Finish: To match shelving units.
- 3. Mounting: Slide-on.
- D. Sliding Shelf Supports: Plastic slider block with chrome plated wire, sliding along back rail.
 - 1. Height: 3 inches.
 - 2. Finish: To match shelving units.
 - 3. Mounting: Snap on.
- E. Label Holders: Steel, attached to front face of shelf.
 - 1. Size: 2-1/4 by 3/4 inches.
 - 2. Finish: Manufacturer's standard.
 - 3. Mounting: Slide-on.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate is level and that clearances are as specified.
- B. Verify that walls are suitable for shelving attachment.
- C. Do not begin installation until substrates have been properly prepared.
- D. 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 the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.
- C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.

3.04 CLEANING

- A. Clean shelving and surrounding area after installation.

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

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Metal Storage Shelving 10 56 13 - 4
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**SECTION 10 56 23
WIRE STORAGE ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High-density storage light duty carts.

1.02 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- C. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.
- E. 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.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- 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.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Rated capacities, construction details, material descriptions, dimensions of individual components, profiles, and finishes.
 - 3. Delivery, storage, handling, and installation instructions and recommendations.
 - 4. Assembly and installation instructions.
 - 5. Description of specialties and accessories.
 - 6. Maintenance instructions and recommendations.

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- C. Shop Drawings: Project-specific drawings indicating details of storage specialties layout and installation, including:
 1. Show components, assemblies, connections, attachments, and anchorage.
 2. Show fabrication and installation details. Distinguish between factory and field work.
 3. Show details of floor recesses where required for storage equipment or carts.
 4. Include clearances, spacing, and relation to adjacent construction in plan, elevation, and section, details, attachments and work by others.
 5. Show system layouts, room locations, clearances, spacing, and relationship to adjacent construction.
 6. Show trim and accessories.
 7. Indicate seismic bracing and fastening requirements.
- D. Product Schedule:
 1. Use designations indicated on the Drawings.
 2. Include room locations, dimensions, accessories, finishes, and project specific notes.
- E. Verification Samples: For each color and finish for each exposed storage specialties component.
 1. Exposed Finishes: Not less than 8 by 10 inches (200 by 250 mm), for each type, color, pattern, surface and material selected.
 2. Exposed Hardware and Accessories: One full size unit for each type and finish.
 3. Shelf Brackets: Cantilevered shelf brackets with attachment hardware.
 4. Vertical Supports: 12-inch (305 mm) section.
 5. Wood Products: 12-inch (305 mm) square.
- F. Closeout Submittals:
 1. Operation and Maintenance Data: For adjusting, repairing and replacing components and accessories.
 2. Warranty: Submit manufacturer's sample warranty.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain storage specialties through one source from a single approved manufacturer.
- B. Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.
- C. Installer Qualifications: Manufacturer's authorized representative, trained and approved for installation of units required for this Project.
- D. Regulatory Requirements: Where components are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

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1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached.
- B. Do not deliver components until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.
- C. Handle and install materials to avoid damage.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
 - 1. Coordinate installation and location of blocking and supports as requested.
 - 2. Verify openings, clearances, storage requirements and other dimensions relevant to the installation and final application.
- C. Coordination:
 - 1. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
 - 2. Coordinate installation of storage specialties to ensure proper installation and operation of each component.
 - 3. Coordinate clearances required for movement of gliding, portable and mobile units.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's written warranty to repair or replace components that fail in materials or workmanship. Failures include the following:
 - 1. Fracturing or breaking components including panels, shelves, or hardware resulting from normal wear and tear and use other than vandalism.
 - 2. Collapse or failure of metal grid locker components not resulting from overloading or vandalism.
 - 3. Delamination or other failures of bonding or assembly.
 - 4. Warping not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
 - 5. Faulty operation of hardware and accessories.
- B. Storage Unit Warranty Period: 10 years.
- C. Cart Warranty Period: 5 years.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Wenger Corporation, including all Wenger, J.R. Clancy and GearBoss product brands. www.wengercorp.com
- B. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
 - 1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time period allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements including: modularity of individual units; ventilation, strength of door, hinge and latch construction; replaceable construction for compartment and foot locker doors; impact and abrasion resistance of surfaces and edge banding.
 - b. Samples of each type of product specified.
 - c. Project References: minimum of 5 installations not less than 5 years old, with owner contact information, available for evaluation by Architect.
 - d. Sample warranty including terms and conditions.
 - 2. Submit substitution request not less than 15 days prior to bid date. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
 - 3. Manufacturer must meet each separate requirements of Submittals Article.

2.02 METAL SHELVING SYSTEMS

- A. GearBoss Metal Shelving Systems, Shelf Starter Bay, Shelf Add-On Bay, and Shelves by Wenger Corporation: Cantilever-type modular metal storage shelving system comprised of the following components:
 - 1. Structural Performance:
 - a. Allowable Load Rating: 1000 lb. (373 kg) per 4 by 8-foot (1219 by 2438-mm) bay.
 - b. Load-Carrying Capacity per 48 inch (1219 mm) Shelf: 250 lb. (113 kg).
 - 2. Shelf Unit Uprights: Steel tube, metallic-coated, 2-inch (50.8 mm) square, 0.109-inch (2.76 mm) thick, with perforations on all four sides at 1 inch (25 mm) on center.
 - 3. Horizontal Stringer: Formed sheet steel, metallic-coated, 0.075-inch (1.9-mm) thick.
 - 4. Shelf Cross Tubes: 14 gauge steel tube, metallic-coated, 5/8-inch (22-mm) square.
 - 5. Shelf Brackets: Formed steel, 0.015-inch (0.38-mm) thick.
 - 6. Laminate-Clad Wood Panels: Core material and thickness indicated, finished with thermally-fused anti-microbial polyester surfacing on both sides.
 - 7. Unit Width: 48 inch (1219 mm) center-to-center unless otherwise indicated.
 - 8. Unit Height: 96 inches (2438 mm).

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9. Unit Height: As indicated on the Drawings.
 10. Shelves can be adjusted in 1 inch (25 mm) increment without tools.
- B. Metal Shelving Materials:
1. Aluminum Extruded Bars, Profiles, and Tubes: ASTM B221.
 2. Sheet Steel: Cold-rolled, ASTM A1008/A1008M, commercial steel, type B.
 3. Steel Tube: ASTM A501/A501M, hot-formed steel tubing.
 4. Steel Wire: ASTM A510/A510M, cold drawn steel wire
 5. Particleboard: To ANSI A208.1, minimum 43 lb/cu. ft. (689 kg/cu. m) density.
 - a. Provide fire retardant treated type.
 6. Plywood: APA standards PS 1 section 5.7.4 or 5.7.1 or ANSI /HPVA HP-1 Panel provide with HDF skins to prevent grain telegraphing.
 7. Steel Tube: ASTM A500/A500M, cold-formed steel tubing.
 8. Laminate Finish: Composite, of thickness indicated, finished with thermally-fused anti-microbial polyester surfacing on both sides, meeting performance properties of NEMA LD 3 for VGS grade, with heat bonded, radiused, 3 mm thick extruded PVC edge banding.
 - a. Surface Abrasion Resistance: Taber Wheel, 400 cycles, for solid colors.
 9. PVC Edge Banding: LMA EDG-1, radiused PVC extrusions, 3 mm thick, heat-bonded.
 10. Anchors and Fasteners:
 - a. Factory Provided: Material, type, and size recommended by manufacturer for secure anchorage to substrate.
 - b. Field Installed: Manufacturer-recommended fasteners furnished by Contractor as required for locker substrate and project requirements.
- C. Metal Shelving Fabrication:
1. Fabricate components square, and rigid. Make exposed metal safe to touch and free of sharp ends or burrs.
 2. Form frames, panels, doors, and accessories from one-piece, or one rigid assembly, unless specifically shown on Shop Drawings.
 3. Factory preassemble metal components by welding all joints, and connections; with no bolts, nuts, screws, or rivets used in assembly, except as required for knock down shipping and attachment to mounting surfaces.
- D. Metal Shelving Accessories:
1. Shelf Depth: 30.5 inches (775 mm) with 4 cross tubes.
 2. Lock Box: Steel sides and bottom, polished aluminum front, key-tab lock, hinged door panel lockable with a key.
 3. Cantilevered Shelf: Steel tube and bracket, with aluminum extrusion nosing, mill finish unless otherwise indicated.
 4. Hinged Panel Doors: Laminate clad panel door 5/8-inch (15.9 mm) thick.
 5. Garment Hanger: Steel round tube mounts underneath shelf; powder-coat finish, black.

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- 6. Quantity of garment bars as indicated on Drawings.
- 7. Drawer: Pull-out utility drawer mounted under work surface.
- E. Metal Shelving Finishes: Manufacturer's standard finish, color as selected by Architect from manufacturer's standard colors.

2.03 HIGH-DENSITY STORAGE HEAVY DUTY MOBILE CARTS

- A. High Density Storage Carts, General: Track-mounted, modular and mobile, high-density storage units with steel tube and sheet chassis and powder-painted steel tube upright frame, powder-painted steel wire grille panels that will support optional cart accessories, with fixed guides in floor track and 4 lateral casters.
- B. Portable Storage Carts, General: Track-mounted, portable, modular, high-density storage units with steel tube and sheet chassis and powder-painted steel tube upright frame, steel wire grille panels that support optional cart accessories with retractable guides in floor track and 4 swivel casters with non-marring wheels.
- C. Top Panels: Unless otherwise indicated, medium density fiberboard, 5/8 inch (15.9 mm) thick, with high-pressure decorative laminate.
- D. Gliding X Carts: High-density storage carts slide together and apart, rolling laterally on fixed aluminum floor track to create aisles between carts and closing back together when not in use to reduce storage space by at least half. Designed to encourage airflow and improve sanitation and odor issues. Modular system purpose made for bulky equipment.
 - 1. Dimensions: 32 inch (81 cm) wide by 78 inch (198 cm) long by 79 inch (201 cm) high.
 - 2. Dimensions: 48 inch (122 cm) wide by 78 inch (198 cm) long by 79 inch (201 cm) high.
 - 3. Chassis: Fabricated from 16-gauge, 14-gauge, and 12-gauge welded steel components.
 - 4. Upright Tubes: 2 inch (51 mm) diameter, 16-gauge steel tubing.
 - 5. End Frames: Resistant welded heavy duty steel wire grill with 1 inch (25 mm) opening.
 - 6. Wheels: 6 inch (152 mm) heavy duty.
 - 7. Roof Panel: Solid 5/8 inch (17 mm) thermofused composite wood with aluminum extrusions, rated for 150 pound (67.5 kg) load.
 - 8. GREENGUARD Indoor Air Quality Certified and GREENGUARD Children & Schools Certified.
 - 9. Paint color as selected from manufacturer's standard range of colors.
- E. Mobile Team Carts: High-density storage carts purpose made for bulky equipment. Mounting system allows equipment to store compactly, engineered to leave the track to travel to gyms, sidelines, practice areas, parking lots or wherever needed. Do not expose to exterior weather conditions for extended periods of time. Carts may be parked and locked in any location or temporary space to create safe secure storage.
 - 1. Dimensions: 32 inch (81 cm) wide by 78 inch (198 cm) long by 79 inch (201 cm) high.
 - 2. Dimensions: 48 inch (122 cm) wide by 78 inch (198 cm) long by 79 inch (201 cm) high.
 - 3. Chassis: Fabricated from 16-gauge, 14-gauge, and 12-gauge welded steel components.
 - 4. Upright Tubes: 2 inch (51 mm) diameter, 16-gauge steel tubing.

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5. End Frames: Resistant welded heavy duty steel wire grill with 1 inch (25 mm) opening.
 6. Wheels: 6 inch (152 mm) heavy duty swivel casters.
 7. Roof Panel: Solid 5/8 inch (17 mm) thermofused composite wood with aluminum extrusions, rated for 150 pound (67.5 kg) load.
 8. GREENGUARD Indoor Air Quality Certified and GREENGUARD Children & Schools Certified.
 9. Paint color as selected from manufacturer's standard range of colors.
- F. Sport Carts: Designed for use in small spaces and sports. Nimble carts will navigate narrow hallways, shorter door openings and most elevators. Provides high-density storage on or off floor mounted tracks. Swing door is self-latching. Lockable and reinforced with 16 gauge metal channels on outer edges.
1. Dimensions: 32 inch (81 cm) wide by 78 inch (198 cm) long by 79 inch (201 cm) high.
 2. Dimensions: 48 inch (122 cm) wide by 78 inch (198 cm) long by 79 inch (201 cm) high.
 3. Chassis: Fabricated from 16-gauge, 14-gauge, and 12-gauge welded steel components.
 4. Upright Tubes: 2 inch (51 mm) diameter, 16-gauge steel tubing.
 5. End Frames: Resistant welded heavy duty steel wire grill with 1 inch (25 mm) opening.
 6. Wheels: Extra wide, 5 inch (127 mm) heavy duty swivel casters with polyurethane non-marring outer roller guides.
 7. Roof Panel: Solid 5/8 inch (17 mm) thermofused composite wood with aluminum extrusions, rated for 150 pound (67.5 kg) load.
 8. GREENGUARD Indoor Air Quality Certified and GREENGUARD Children & Schools Certified.
 9. Paint color as selected from manufacturer's standard range of colors.
- G. High-Density, Heavy Duty Mobile Cart Materials:
1. Aluminum Extruded Bars, Profiles, and Tubes: ASTM B221.
 2. Sheet Steel: Cold-rolled, ASTM A1008/A1008M, commercial steel, type B.
 3. Steel Tube: ASTM A501/A501M, hot-formed steel tubing.
 4. Steel Tube: ASTM A500/A500M, cold-formed steel tubing.
 5. Steel Wire: ASTM A510/A510M, cold drawn steel wire
 6. Anchors and Fasteners:
 - a. Factory Provided: Material, type, and size recommended by manufacturer for secure anchorage to substrate.
 - b. Field Installed: Manufacturer-recommended fasteners furnished by Contractor as required for locker substrate and project requirements.
- H. High-Density, Heavy Duty Mobile Cart Fabrication:
1. Fabricate components square, and rigid. Make exposed metal safe to touch and free of sharp ends or burrs.

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2. Form frames, panels, doors, and accessories from one-piece, or one rigid assembly, unless specifically shown on Shop Drawings.
 3. Factory preassemble metal components by welding all joints, and connections; with no bolts, nuts, screws, or rivets used in assembly, except as required for knock down shipping and attachment to mounting surfaces.
- I. High-Density, Heavy Duty Gliding Cart Accessories:
1. Storage Cart Floor Track: Extruded aluminum track, 6 by 0.97 inch tall (152 by 25 mm tall), configured to receive storage unit track guides. Includes appropriate track or island stops.
 - a. Track: Recessed floor track.
 2. Shelves:
 - a. Description: Steel wire grille, powder-painted, 150 lb. (68 kg) capacity per shelf unit, bracket-hung from steel powder-painted, grille panels, adjustable in 1 inch (25.4 mm) height increments.
 - b. Depth: 24 inch (610 mm).
 - c. Depth: 32 inch (810 mm).
 - d. Liners: Plastic sheet, sized to fit shelf, with securing clips
 - 1) Depth: 24 inch (610 mm).
 - 2) Depth: 32 inch (810 mm).
 - 3) Quantity: As indicated on the Drawings.
 - e. Shelf Lips: Steel sheet lip, powder-painted, 2-1/2 or 4 inch (63.5 or 102 mm) high, fastened to shelf with adjustable thumbscrews.
 3. Garment Bars: Steel tube, 1-1/2 inch (38 mm) diameter, powder-painted, bracket hung from steel grille end panels, adjustable in 1 inch (25.4 mm) increments.
 4. Truss Hangers: Double-bar steel truss hanger for support of helmet hangers and shoulder pad hangers.
 - a. Football Helmet Hanger: Formed, powder-painted steel wire, 5/16 inch diameter, 8 helmet capacity.
 - b. Football Shoulder Pad Hanger: Formed, powder-painted steel wire, long and short lengths configured to hang in pairs, one pad per hanger. Provide short or long as shown on the drawings.
 5. Football Shoulder Pad Stackers: Built-in shoulder pad form, powder-painted steel sheet and steel wire upright stacker, with 4 wheels, wire handles, configured to fit into storage unit chassis; 18 to 20 pad capacity.
 6. Grille End Panels: Laminated, solid panel, 5/8 inch (15.9 mm) thick with black edge band. Installed over cart end grille panels.
 - a. Width: 32 inches (813 mm).
 - b. Width: 48 inches (1220 mm).
 - c. Laminate Color: As selected from manufacturer's standard color options.

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7. Side Closures: Laminated, solid panel, 5/8 inch (15.9 mm) thick with black edge band. Installed on 6 foot-6 inch (1981 mm) cart side.
 - a. Laminate Color: As selected from manufacturer's standard color options.
 8. Doors: Bypass type doors, laminated, solid panel, medium density fiberboard, 5/8 inch (15.9 mm) thick, with padlock eye. Padlock by owner. Installed on 6 foot-6 inch (1981 mm) cart side.
 9. Soft Mesh Divider: Vinyl mesh that attaches to end grille panels, dividing cart in half lengthwise.
 10. Accessory Colors: as selected from manufacturer's standard range.
- J. High-Density, Heavy Duty Mobile Cart Accessories:
1. Storage Cart Floor Track: Extruded aluminum track, 6 by 0.97 inch tall (152 by 25 mm tall), configured to receive storage unit track guides. Includes appropriate track or island stops.
 - a. Track: Recessed floor track.
 2. Shelves:
 - a. Description: Steel wire grille, powder-painted, 150 lb. (68 kg) capacity per shelf unit, bracket-hung from steel powder-painted, grille panels, adjustable in 1 inch (25.4 mm) height increments.
 - b. Depth: 24 inch (610 mm).
 - c. Depth: 32 inch (810 mm).
 - d. Liners: Plastic sheet, sized to fit shelf, with securing clips.
 - 1) Depth: 24 inch (610 mm).
 - 2) Depth: 32 inch (810 mm).
 - 3) Quantity: As indicated on the Drawings.
 - e. Shelf Lips: Steel sheet lip, powder-painted, 2-1/2 or 4 inch (63.5 or 102 mm) high, fastened to shelf with adjustable thumbscrews.
 3. Garment Bars: Steel tube, 1-1/2 inch (38 mm) diameter, powder-painted, bracket hung from steel grille end panels, adjustable in 1 inch (25.4 mm) increments.
 4. Truss Hangers: Double-bar steel truss hanger for support of helmet hangers and shoulder pad hangers.
 - a. Football Helmet Hanger: Formed, powder-painted steel wire, 5/16 inch diameter, 8 helmet capacity.
 - b. Football Shoulder Pad Hanger: Formed, powder-painted steel wire, long and short lengths configured to hang in pairs, one pad per hanger. Provide short or long as shown on the drawings.
 5. Football Shoulder Pad Stackers: Built-in shoulder pad form, powder-painted steel sheet and steel wire upright stacker, with 4 wheels, wire handles, configured to fit into storage unit chassis; 18 to 20 pad capacity.
 6. Grille End Panels: Laminated, solid panel, 5/8 inch (15.9 mm) thick with black edge band. Installed over cart end grille panels.

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- a. Width: 32 inches (813 mm).
 - b. Width: 48 inches (1220 mm).
 - c. Laminate Color: As selected from manufacturer's standard color options.
7. Side Closures: Laminated, solid panel, 5/8 inch (15.9 mm) thick with black edge band. Installed on 6 foot-6 inch (1981 mm) cart side.
- a. Laminate Color: As selected from manufacturer's standard color options.
8. Doors: Bypass type doors, laminated, solid panel, medium density fiberboard, 5/8 inch (15.9 mm) thick, with padlock eye. Padlock by owner. Installed on 6 foot-6 inch (1981 mm) cart side.
9. Soft Mesh Divider: Vinyl mesh that attaches to end grille panels, dividing cart in half lengthwise.
10. Accessory Colors: as selected from manufacturer's standard range.
- K. High-Density, Heavy Duty Sports Cart Accessories:
- 1. Storage Cart Floor Track: Extruded aluminum track, 6 by 0.97 inch tall (152 by 25 mm tall), configured to receive storage unit track guides. Includes appropriate track or island stops.
 - a. Track: Recessed floor track.
 - 2. Shelves:
 - a. Description: Steel wire grille, powder-painted, 150 lb. (68 kg) capacity per shelf unit, bracket-hung from steel powder-painted, grille panels, adjustable in 1 inch (25.4 mm) height increments.
 - b. Hat Shelf Depth: 32 inch (810 mm).
 - c. Liners: Plastic sheet, sized to fit shelf, with securing clips.
 - 1) Depth: 32 inch (810 mm).
 - 2) Quantity: As indicated on the Drawings.
 - d. Shelf Lips: Steel sheet lip, powder-painted, 2-1/2 or 4 inch (63.5 or 102 mm) high, fastened to shelf with adjustable thumbscrews.
 - 3. Garment Bars: Steel tube, 1-1/2 inch (38 mm) diameter, powder-painted, bracket hung from steel grille end panels, adjustable in 1 inch (25.4 mm) increments.
 - 4. Truss Hangers: Double-bar steel truss hanger for support of helmet hangers and shoulder pad hangers.
 - a. Football Helmet Hanger: Formed, powder-painted steel wire, 5/16 inch diameter, 8 helmet capacity.
 - b. Football Shoulder Pad Hanger: Formed, powder-painted steel wire, long and short lengths configured to hang in pairs, one pad per hanger. Provide short or long as shown on the drawings.
 - 5. Football Shoulder Pad Stackers: Built-in shoulder pad form, powder-painted steel sheet and steel wire upright stacker, with 4 wheels, wire handles, configured to fit into storage unit chassis; 18 to 20 pad capacity.

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6. Grille End Panels: Laminated, solid panel, 5/8 inch (15.9 mm) thick with black edge band. Installed over cart end grille panels.
 - a. Width: 32 inches (813 mm).
 - b. Laminate Color: As selected from manufacturer's standard color options.
7. Side Closures: Laminated, solid panel, 5/8 inch (15.9 mm) thick with black edge band. Installed on 6 foot-6 inch (1981 mm) cart side.
 - a. Laminate Color: As selected from manufacturer's standard color options.
8. Doors: Bypass type doors, laminated, solid panel, medium density fiberboard, 5/8 inch (15.9 mm) thick, with padlock eye. Padlock by owner. Installed on 6 foot-6 inch (1981 mm) cart side.
9. Soft Mesh Divider: Vinyl mesh that attaches to end grille panels, dividing cart in half lengthwise.
10. Accessory Colors: as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Proceed with installation only after correction of unsatisfactory conditions.

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.

3.03 INSTALLATION

- A. Install components plumb, level, and true; using integral levelers and anchors in accordance with manufacturer's recommendations, shop drawings and other approved submittals.
- B. Metal Shelving Requirements:
 1. Anchor uprights to walls using anchors of type, size, and spacing recommended by manufacturer.
 2. Install shelves in each unit.
 3. Erect cantilever adjustable uprights to substrate with a maximum tolerance from vertical of 1/4 inch (6 mm).

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4. Adjust metal shelving so connectors and other components engage accurately and securely. Verify modular components fit easily into alternate locations without force or use of tools.
- C. High-Density Cart Requirements:
1. Assemble units. Install and anchor unit tracks.
 - a. Recessed tracks, installed by others, shall be fully grouted.
 2. Comply with the following tolerances:
 - a. Install tracks on concrete, parallel and level within 3/32 inch (2.3 mm) for each 8 feet (2133 mm) length;
 - b. 1/16 inch (1.5 mm) between adjacent tracks perpendicular to track direction;
 - c. 1/32 inch in 10 feet (0.8 mm in 3 m) of track length.
 3. Set gliding storage carts in track and adjust to comply with storage cart manufacturer's written requirements.
 4. Portable and Mobile Storage Cart Installation: Assemble units. Set portable carts in indicated storage position or in track.
- D. Install seismic fastening in accordance with approved shop drawings.
- E. Fasten components to adjacent construction through back, near top and bottom. Fasten at indicated height using fasteners recommended by manufacturer. Comply with mounting height requirements for accessible components.
- F. Through-bolt adjacent units using connector bolts provided by manufacturer.
- G. Install hardware uniformly and precisely without binding.
1. Adjust and align hardware so moving parts operate freely and contact points meet accurately.
 2. Allow for final adjustment after installation to ensure hardware operates smoothly without warping or binding and closes with uniform reveals.

3.04 DEMONSTRATION AND TRAINING

- A. Train Owner's personnel to adjust, operate, and maintain storage specialties.
- B. Turn over keys, tools, and operation and maintenance instructions to Owner.

3.05 CLEANING AND PROTECTION

- A. Repair or replace defective work as directed by Architect upon inspection.
- B. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.
- C. Turn over operation and maintenance instructions to Owner. Instruct the Owner's personnel upon request.

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- D. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

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**SECTION 11 30 13
APPLIANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Laundry 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. Section 11 40 00 - Foodservice Equipment: General requirements covering all food service equipment work; manufactured equipment items.
- D. Division 22 - Plumbing: Water supply, and sanitary drainage and vent piping and specialties.
- E. Division 22 - Plumbing: Faucets and fittings; specialty food service fixtures.
- F. 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 - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. CBC Ch. 11B - California Building Code-Chapter 11B.
- 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.

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- 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 District'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).
- C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

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.
- C. Accessibility Compliance: Appliances are required to comply with ADA Standards and CBC Ch. 11B, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
 1. CBC Ch. 11B-804.6.2 Operable parts: Comply with clear space, heights, handles, pulls, latches, locks, and other operable parts on accessible doors; with CBC Section 11B-309.4 and be operable with one hand and not require tight grasping, pinching, or twisting of the wrist.
 2. CBC Ch. 11B-11B-804.6.3 Dishwasher.
 3. CBC Ch. 11B-11B-804.6.4 Range or Cooktop.
 4. CBC Ch. 11B-11B-804.6.5 Oven.
 5. CBC Ch. 11B-11B-804.6.6 Refrigerator/Freezer.

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.

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1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 LAUNDRY APPLIANCES

- A. Clothes Washer: Front-loading OFOI.
 - 1. ADA Standards Compliant
 - 2. Size: Large capacity.
 - 3. Controls: Solid state electronic.
 - 4. Cycles: Include normal.
 - 5. Motor Speed: Single-speed.
 - 6. Features: Include optional second rinse, bleach dispenser, fabric softener dispenser, self-cleaning lint filter, sound insulation, and end of cycle signal.
 - 7. Finish: Painted steel color white.
 - 8. Pedestal: ADA Height.
 - 9. Hot and Cold Water Faucet (Hose Bibb) Connections: 1/2 inch hose thread, with 20-100 PSI.
 - 10. Included Hose length: 4 feet
 - 11. Standpipe Drain: 2 inches.
 - 12. Electrical: 120V, 20A single phase , 3-wire grounded, Dedicated circuit.
- B. Clothes Dryer: Electric, stationary. OFOI
 - 1. ADA Compliant.
 - 2. Size: Large capacity.
 - 3. Controls: Solid state electronic, with electronic moisture-sensing dry control.
 - 4. Temperature Selections: One.
 - 5. Heating Element: Electric
 - 6. Cycles: Include normal, permanent press, knit/delicate, and air only.
 - 7. Features: Include interior light, reversible door, stationary rack, sound insulation, and end of cycle signal.
 - 8. Electrical: single phase, 120/240V, 30A Dedicated circuit.
 - a. Cord: 3 wire, 6 ft long, 10 ga. solid copper.
 - b. Terminals: Ring or upturned spade terminals and NEMA 10-30R receptacle.
 - 9. Vent: 4 inch diameter.
 - a. Flexible duct is limited to 7 ft length.

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- b. 4 inch diameter rigid sheet metal duct. Length shall be limited to manufacturer's guidelines or as noted on Mechanical Drawings.
 - c. Exhaust Outlet: Louvered hood style, place 12 inches above grade or objects.
10. Finish: Painted steel, color as scheduled.
11. Pedestal: ADA height.

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. Anchor built-in equipment in place.

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 District 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.

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B. Protect finished work from damage.

END OF SECTION

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SECTION 11 40 00

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

- A. The work referred to in this section consists of furnishing all labor and material required to provide and deliver all equipment hereinafter specified into the building. Specified equipment must be supplied per specifications without substitution. If "or equal" is adjacent to model number substitutions may be accepted if all criteria of specified brand is met or exceeded. If the alternate model is not approved by the owner/School District for any reason the specified item must be supplied at no additional cost. Un-crate, assemble, hang, set in place, level, and completely install all equipment, exclusive of final utility connections. Final utility connections to all equipment shall be part of the work under additional appropriate sections of the work and not part of the food service work.
- B. Coordinate Owner/School District and Vendor-supplied equipment noted on the drawings or in the specifications as NIKEC. Show on roughing in Plans and sizes, utilities, and other requirements as furnished in the Specifications, by Owner/School District or appropriate supplier in submittals as if the equipment is contractor furnished.
- C. Field measurements shall be made prior to installation of any equipment item.
- D. The cutting of holes in equipment for pipe, drains, electrical outlets, etc., required for this installation, shall be part of this work. Work shall conform to the highest standards of workmanship and shall include welded sleeves, collars, ferrules and escutcheons.
- E. Repair of all damage to the premises as a result of the equipment installation as well as the removal of all debris left by the work of this section.
- F. Food service equipment and fixtures shall be cleaned and ready for operation at the time the facility is turned over to the Owner/School District for final inspection by the Owner's/School District's Representative.

1.02 RELATED DOCUMENTS

- A. Related Sections include the following:
 - 1. Division 1 Section "Product Requirements". Conditions for acceptance of products by manufacturers and for substitutions. Unless specifically noted, no substitutions will be considered
 - 2. Division 1 Section "Warranty"
 - 3. Division 5 Section "Metal Fabrications" for equipment supports.
 - 4. Division 6 Section "Interior Architectural Woodwork" for wood casework and plastic-laminate substrates.
 - 5. Divisions 22-23 Section "Supports, Anchors and Seals". General requirements for supports and anchors for pipe and duct systems associated with food service equipment.

6. Refer to Division 23 "Heating, Ventilation, and Air Conditioning (HVAC)" for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire-extinguishing systems; and other materials required to complete food service equipment installation.
 7. Division 26 Section "Electrical" for connections to fire alarm systems, wiring, disconnects, and general requirements and other electrical materials required in addition to those specified, as applicable to electrical work associated with food service equipment.
- B. Allowances: Furnish food service equipment under the allowances indicated as specified in Division I Section "Allowances".
 - C. All electric services including wiring to, and final connections to, the fixtures except, as specified differently in the specifications, drawings, or herein.
 - D. All water, waste and gas services to the fixtures including shut-off valves, trim, traps, etc., and final connections to the fixtures, except as specified differently in the specifications, drawings, or herein.
 - E. All hood or ventilator duct work above the connection position on such exhaust hoods or exhaust ventilators, except as specified differently in the specifications, drawings, or herein. Final welded connections at the junction point of exhaust hoods or exhausts ventilators, shall be part of the food service work.
 - F. Floors, quarry tile, concrete bases, walls, ceilings, finishes and related building work, except as specified differently in the specifications, drawings or herein.

1.03 DEFINITIONS

- A. Terminology Standard: Refer to NSF 2, "Food Equipment" or other applicable NSF standards for definitions of food service equipment and installation terms not otherwise defined in this Section or in other referenced standards.
- B. OFOI: Owner Furnished Owner Installed Equipment. Where indicated, Owner/School District will furnish and install equipment items.
- C. OFCI: Owner Furnished Contractor Installed Equipment. Where indicated, Owner/School District will furnish equipment to be installed by Contractor.
- D. CFCI: Contractor Furnished Contractor Installed Equipment.
- E. NIKEC: Not Included in Kitchen Equipment Contract.
- F. KEC: Kitchen Equipment Contractor

1.04 SUBMITTALS

- A. Product Data: For each type of food service equipment indicated. Include manufacturer's specification and cut sheet with model number etc. and cover page indicating utility etc., and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel, and service-connections including roughing-in dimensions.
- B. Shop Drawings: For food service equipment not manufactured as standard production and catalog items by manufacturers. Include plans, elevations, sections, roughing-in dimensions, fabrication details, service requirements, and attachments to other work.

1. Wiring Diagrams: Details of wiring for power, signal, and control systems and differentiating between manufacturer-installed and field-installed wiring.
 2. Piping Diagrams: Details of piping systems and differentiating between manufacturer-installed and field-installed piping.
- C. Coordination Drawings: For locations of food service equipment and service utilities. Key equipment with item numbers and descriptions indicated in Contract Documents. Include plans and elevations of equipment, access- and maintenance-clearance requirements, details of concrete or masonry bases and floor depressions, and service-utility characteristics.
- D. Contract Document Drawings:
1. Drawings furnished, constitute a part of these specifications show locations of equipment and general arrangement of mechanical and electrical services. Necessary deviation from the illustrated arrangements to meet structural conditions, shall be considered a part of the work of this section. Such deviations shall be made without expense to the owner/School District.
 2. The drawings are for the assistance and guidance of the Food Service Equipment Contractor. Exact locations shall be governed by the building configuration. The Food Service Equipment Contractor shall accept his contract with this understanding.
 3. Should there be a conflict between the drawings and the specifications, the specifications shall govern. Upon discovery, all errors, omissions, conflicts, and ambiguities are to be submitted to the Architect via formal RFI for clarification and resolution. A clarification memo or addendum will be issued, if required. If no RFI is submitted, the Contractor shall assume responsibility for that which places the greatest burden upon the Contractor. No allowances will be made in favor of the Contractor for errors, omissions, conflicts, or ambiguities reported after award of contract.
- E. Utility Roughing-in Drawings:
1. The Food Service Equipment Contractor shall prepare and submit one bond or a valid print, of all roughing-in drawings, showing information necessary for the roughing-in of refrigerant lines, syrup/beer lines, plumbing, steam, mechanical and electrical utility requirements. Drawings shall also include construction requirements necessary for all equipment including floor depressions, raised bases, wall blocking, wall recesses and any critical dimensions for specific equipment requirements. Approval will be made upon one print which will be returned to the Food Service Equipment Contractor for reproduction purposes. Drawings not properly submitted in this format, will not be reviewed. Drawings without an "Approved" or an "Approved as Noted" stamp, will not be reviewed. Drawings without an "Approved as noted" stamp, will not be considered an authorized shop drawing and will not be allowed on the job site.
 - a. Furnished four (4) sets "Approved" and/or "Approved as Noted" shop drawings, for distribution to the field, as directed.

- F. Shop Fabrication Drawings: The Food Service Equipment Contractor shall prepare and submit one bond or original print, of all shop drawings, showing all information necessary for fabrication and installation of the work of this section. Approval will be made upon one print which will be returned to the Food Service Equipment Contractor for reproduction purposes. Drawings not properly submitted in this format, will not be reviewed. Drawings without an "Approved" or an "Approved as Noted" stamp, will not be considered an authorized shop drawing and will not be allowed on the job site.
- G. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for exposed products with color finishes.
- H. Samples for Verification: Of each type of exposed finish required, minimum 4-inch- (100-mm-) square or 6-inch- (150-mm-) long sections of linear shapes and of same thickness and material indicated for work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- I. Product Certificates: Signed by manufacturers of refrigeration systems or their authorized agents certifying that systems furnished comply with requirements and will maintain operating temperatures indicated in the areas or equipment that they will serve.
- J. Maintenance Data: Operation, maintenance, and parts data for food service equipment to include in the maintenance manuals specified in Division 1. Include a product schedule as follows:
 - 1. Product Schedule: For each food service equipment item, include item number and description indicated in Contract Documents, manufacturer's name and model number, and authorized service agencies' addresses and telephone numbers.

1.05 QUALITY ASSURANCE

- A. Kitchen Equipment Contractor Qualifications: Kitchen Equipment Contractor (KEC) to be licensed by state regulating board and shall have completed no fewer than five (5) Food Service Installations similar in material, design, and extent to that indicated for this Project, which have resulted in satisfactory in-service performance.
- B. Fabricator Qualifications: Fabricators shall have been regularly engaged in the manufacture of Food Service Equipment of the types, capacities, and sizes required, whose products have been in satisfactory use in similar service for no fewer than five (5) years.
- C. Source Limitations: Obtain each type of food service equipment through one source from a single manufacturer.
- D. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equal size and performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to food service equipment including, but not limited to, the following:
 - 1. Review access requirements for equipment delivery.
 - 2. Review equipment storage and security requirements.
 - 3. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

4. Review structural loading limitations.
 5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- F. All equipment shall be provided new, in unused condition, and of the latest manufacturer's model, unless otherwise specified. If the model specifications vary significantly from the item specified, provide equipment submittal for review and approval for installation.

1.06 CODES AND REGULATIONS

- A. All work shall be in strict conformance with all federal, state, local codes, laws, regulations, and rules of agencies/authorities having jurisdiction.
- B. All work under this section shall comply, as applicable, with:
 1. National Fire Protection Association Standard(NFPA), including NFPA 17, NFPA 17A, NFPA 54, NFPA 70, NFPA 96.
 2. National Sanitation Foundation (NSF), including NSF-7. Provide equipment that bears NSF Certification Mark.
 3. Underwriters Laboratories (UL). Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.
 4. Baking Industry Sanitation Standards Committee (BISSC). Provide bakery equipment that complies with current ANSI/BISSC/Z50.2. standard section 3.0 General Principles of Design
 5. National Electric Manufacturer's Association (NEMA)
 6. American Society of Mechanical Engineers must carry the (ASME) stamp. Fabricate and label steam-generating and closed steam-heating equipment to comply with ASME Boiler and Pressure Vessel Code.
 7. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration".
 8. Occupational Safety and Health Act (OSHA) Standards.
 9. American Disability Act (ADA) Standards.
 10. California Building Code (CBC).
 11. California Fire Code (CFC).
 12. California Electrical Code (CEC).
 13. American Gas Association (AGA)
 14. American National Standards Institute (ANSI). Comply with applicable ANSI standards for electric-powered and gas-burning appliances; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.
 15. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

- a. Where applicable, fabricate food service equipment to comply with SMACNA "Kitchen Equipment Fabrication Guidelines", unless otherwise indicated.
 - b. Seismic Restraints: When applicable, provide seismic restraints for food service equipment according to the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines," appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment," unless otherwise indicated.
16. Listing and Labeling: Provide electrically operated equipment or components specified in this Section that are listed and labeled.
- a. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - b. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
17. Accessibility
- a. Food Service Equipment: Where provided, check-out aisles, sales counters, service counters, food service lines, queues, and waiting lines shall comply with CBC Sections 11B-227 and 11B-904. The top of tray slides shall be 28" minimum and 34" maximum above the finish floor or ground. Space and elements within food service employee work areas shall meet the requirements of CBC Section 11B-203.9 only.
 - b. Lockers: CBC Section 11B-225.2.1. At least 5%, but no fewer than one of each type of lockers shall be ADA accessible and comply with CBC Section 11B-811.
 - c. Provide U-Shaped pulls or touch latches at all accessible casework. CBC Section 11B-811.4
 - d. Walk-in coolers and freezers shall have entry and exit door hardware that complies with all of the requirements of CBC Section 11B-404.2.8.1 and maneuvering clearances at the exterior side per CBC Section 11B-404.2.4 and 11B-404.2.4.4. Doors shall be flush (in-fitting) type, self-closing, 36-inches by a minimum of 80-inches high.
 - e. Walk-in cooler and freezer doors shall be mounted with three cam-lift hinges and posi-seal (hydraulic, not spring) adjustable door closers. Door hardware shall be chrome plated. Mounting height of latching hardware shall be 34 to 40 inches above finish floor. All hardware shall meet the requirements of CBC 11B-404.2.7 and 11B-309.4.
 - f. Walk-in coolers and freezers shall have level maneuvering clearances at the exterior side (CBC 11B-404.2.4) and accessible entry and exit door hardware (CBC 11B-404.2.7).
- C. The Kitchen Equipment Contractor shall certify that all work and materials comply with Federal, State and Local laws, ordinances, and regulations, and is confirmed by the local inspector having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver Food Service Equipment in containers designed to protect the equipment and finish until installation. Make arrangements to receive equipment, when required, at the project site or to hold in a warehouse until delivery can be made to the job site.

- B. Storage: Store Food Service Equipment in the original containers and in a location to provide adequate protection to equipment while not interfering with other construction operations.
- C. Handling: Handle Food Service Equipment carefully to avoid damage to components, enclosures, and finish. Do not install damaged Food Service Equipment. Replace and return damaged components to the Manufacturer.
- D. Owner Furnished Equipment: The KEC will receive, accept and store the Owner/School District Furnished Equipment until installation. The KEC shall assume responsibility for the equipment and its condition upon receipt of the equipment by him or his representative.

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions and proceed with fabricating equipment without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.09 COORDINATION

- A. Coordinate equipment layout and installation with other work, including light fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate location and requirements of service-utility connections.
- C. Coordinate size, location, and requirements of concrete bases, positive slopes to drains, floor depressions, and insulated floors. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- D. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.10 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner/School District of other rights the Owner/School District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Warranty period: 2 years from date of completion. Refer to Division 1 Section "Warranty" for warranty information.
- B. Refrigeration Compressor Warranty: 5 years from date of completion. Submit a written warranty signed by manufacturer agreeing to repair or replace compressors that fail in materials or workmanship within the specified warranty period.
- C. Not included in warranty:
 - 1. Breakage – Due to negligence
 - 2. Faulty operation

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bar. ASTM A 666, Type 304, stretcher leveled, and in finish specified in "Stainless Steel Finishes" Article.
- B. Stainless-Steel Tube: ASTM A 554, Grade MT-304, and in finish specified in "Stainless-Steel Finishes" Article.
- C. Zinc-Coated Steel Sheet: ASTM A 653, G115 (ASTM A 653M, Z350) coating designation; commercial quality; cold rolled; stretcher leveled; and chemically treated.
- D. Zinc-Coated Steel Shapes: ASTM A 36 (ASTM A 36M), zinc-coated according to ASTM A 123 requirements.
- E. Plastic Laminate: Complying with NEMA LD 3 and NSF 35 requirements; NSF certified for end-use application indicated; 0.050 inch (1.27 mm) thick for horizontal and vertical surfaces and 0.042 inch (1.07 mm) thick for post-formed surfaces; smooth texture; and easily cleanable.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
- F. Plywood and Lumber: Provide plywood and lumber as specified in Division 6 Section "Interior Architectural Woodwork."
- G. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- H. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class 1 (clear), Quality q3 (glazing select). Provide products complying with ANSI Z97.1, manufactured by horizontal (roller-hearth) process, and 6 mm thick, unless otherwise indicated. Provide exposed safety edges, if any, seamed before tempering.
- I. Plastic: Except for plastic laminate, provide plastic materials and components complying with NSF 51.
- J. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8-inch (3-mm) thickness that does not chip, flake, or blister.
- K. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds.

2.02 ACCESSORIES

- A. Cabinet Hardware: Provide NSF-certified, stainless-steel hardware for equipment items as indicated.

- B. Casters: NSF-certified, standard-duty, stainless-steel, swivel stem casters with 5-inch- (125-mm-) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width, and 200-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.

2.03 FABRICATION, GENERAL

- A. Fabricate food service equipment according to NSF 2 requirements. Factory assemble equipment to greatest extent possible.
- B. Plastic-Laminate and Wood Casework: Fabricate according to requirements specified in Division 6 Section "Interior Architectural Woodwork."
- C. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Provide ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 - 1. Welded Butt Joints: Provide full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 - 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 - 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and un-depressed.
 - 4. Coat unexposed stainless-steel welded joints with suitable metallic-based paint to prevent corrosion.
 - 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780.
- D. Fabricate field-assembled equipment prepared for field-joining methods indicated. For metal butt joints, comply with referenced SMACNA standard, unless otherwise indicated.
- E. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- F. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- G. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- H. Provide surfaces in food zone, as defined in NSF 2, free from exposed fasteners.
- I. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- J. Provide pipe slots on equipment with turned-up edges and sized to accommodate service and utility lines and mechanical connections.
- K. Provide enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- L. Seismic Restraints:

1. Fabricate to comply with referenced "SMACNA Guidelines for Seismic Restraint of Kitchen Equipment" in any State, province, or jurisdiction that has legislated this requirement as necessary for acceptance. This shall include:
 - a. Identifying these items on his submittal drawings, Plans, Elevations, and Sections.
 - b. Showing required SMACNA methods of restraint on his submittal drawings.
 - c. Referencing the appropriate detail(s).
 - d. Obtain regulatory approval for all seismic engineering details
- 2.04 **STAINLESS-STEEL EQUIPMENT:** for all parts of custom tables, tops, benches, sinks, cabinets, etc., as drawn or as specified, shall be AICI type 304 (18-8 Austenitic). All gauges called for shall be U.S. Standard Gauges. "S/S" or "S.S.", as shown in the drawings or specifications, shall indicate stainless steel.
- A. Edges and Backsplashes: Provide equipment edges and backsplashes indicated complying with referenced SMACNA standard, unless otherwise indicated.
 - B. Apply sound dampening to underside of metal work surfaces, including sinks and similar units. Provide coating with smooth surface and hold coating 1 inch (25 mm) back from open edges for cleaning.
 - C. Tables: Fabricate with reinforced tops, legs, and reinforced undershelves or cross bracing to comply with referenced SMACNA standard, unless otherwise indicated, and as follows:
 1. Tops: Minimum 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.
 2. Legs: 1-5/8 inch (41.3 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset and adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 3. Undershelves: Minimum 0.625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
 4. Top and Underself Reinforcement: Provide minimum 0.0781-inch- (1.984-mm-) thick, stainless-steel reinforcing, unless otherwise indicated.
 5. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
 - D. Base Cabinets: Fabricate with reinforced tops, bases, and reinforced undershelves to comply with referenced SMACNA standard, unless otherwise indicated, and as follows:
 1. Bodies: Minimum 0.0500-inch (1.27-mm) thick stainless steel, unless otherwise indicated.
 2. Tops: Minimum 0.0781-inch (1.984-mm) thick stainless steel, unless otherwise indicated.
 3. Bases, as indicated on Drawings and Specifications:
 - a. Legs: 1-5/8 inch (41.3 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset and adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 - b. Curb: 0.079-inch (2.0066-mm) thick galvanized steel, fully welded and reinforced where necessary

4. Undershelves: Minimum 0.625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
 5. Top and Undershelf Reinforcement: Provide minimum 0.0781-inch- (1.984-mm-) thick, stainless-steel reinforcing, unless otherwise indicated.
- E. Sinks: Fabricate of minimum 0.0781-inch- (1.984-mm-) thick stainless steel with fully welded, 1-piece construction. Construct 2 sides and bottom of sink compartment from 1 stainless-steel sheet with ends welded integral and without overlapping joints or open spaces between compartments. Provide double-wall partitions between compartments with 1/2-inch- (13-mm-) radius rounded tops that are welded integral with sink body. Cove horizontal, vertical, and interior corners with 3/4-inch (19-mm) radius. Pitch and crease sinks to waste for drainage without pooling. Seat wastes in die-stamped depressions without solder, rivets, or welding.
1. Wastes: 2-inch (50-mm) nickel-plated bronze, rotary-handle waste assembly with stainless-steel strainer plate and nickel-plated brass, connected overflow.
 2. Drainboards: Minimum 0.0781-inch- (1.984-mm-) thick stainless steel, pitched to sink at 1/8 inch/12 inches (3 mm/300 mm) of length. Reinforce drainboards with minimum 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.
 3. Legs: 1-5/8 inch (41.3 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset welded to 0.1094-inch- (2.779-mm-) thick, stainless-steel support plate. Provide adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 4. Drainboard Braces: 1 inch (25 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
 5. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
- F. Wall Shelves and Overshelves: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated, and with minimum 0.0625-inch- (1.588-mm-) thick, stainless-steel shelf tops and 0.078 (14 ga.) stainless-steel brackets.
- G. Drawers: Provide lift-out type, 1-piece, die-stamped drawer pan fabricated from 0.050-inch- (1.27-mm-) thick stainless steel with radius corners inside. Support drawer pan with 0.0625-inch- (1.588-mm-) thick, stainless-steel channel frame welded to drawer front. Provide 1-inch- (25-mm) thick, double-wall front fabricated from 0.0625-inch- (1.588-mm-) thick stainless steel and with integral recessed pull. Fill void in drawer front with semi-rigid fiberglass sound dampening. Mount drawers on NSF-certified, full-extension, stainless-steel drawer slides that have minimum 100-lb (45-kg) load capacity per pair, ball-bearing rollers, and positive stop. Mount drawer slides for self-closing on drawer housing as indicated.
- H. Doors: Provide hinged, stainless steel Type 304, 0.0500-inch (1.27-mm) thick doors, unless otherwise indicated.
1. Double pan construction. Outside pan to have corners welded, ground smooth, and polished. Inner pan to be fitted tightly into outer pan with rigid sound deadening material such as Styrofoam.
 2. Door overall thickness to be 0.75" (19-mm) for non-refrigerated, 1-inch (25-mm) for refrigerated compartments with deep draw insulated interior liner, unless otherwise noted. Provide reinforcing to prevent flexing.

3. Doors to be flush with mullions and have integral door pulls.
4. Provide with self-aligning 20-lb pull magnetic catches, aligned with door pulls.

2.05 EXHAUST HOOD FABRICATION

- A. General: Fabricate hoods indicated from minimum 0.050-inch- (1.27-mm-) thick stainless steel, unless otherwise indicated. Comply with NFPA 96 and requirements of authorities having jurisdiction.
 1. Refer to Division 23 Sections for duct, fan, damper, and fire-extinguishing system requirements.
- B. Grease Removal: Provide removable, stainless-steel, grease filters width per drawing. Provide, minimum 0.0781-inch- (1.984-mm-) thick, stainless-steel filter frame and removable collection basins or troughs.
- C. Light Fixtures: Provide NSF-certified fixtures with lamps, vapor-tight sealed lenses, and wiring in stainless-steel conduit on hood exterior.
- D. Exhaust-Duct Collars: Minimum 0.0625-inch- (1.588-mm-) thick stainless steel.

2.06 STAINLESS-STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
 1. Remove or blend tool and die marks and stretch lines into finish.
 2. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. Concealed Surfaces: No. 2B finish (bright, cold-rolled, unpolished finish).
- C. Exposed Surfaces: No. 4 finish (bright, directional polish).
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- E. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

2.07 WALK-IN COOLERS/FREEZER

- A. Panel Construction:
 1. Panels shall be pre-fabricated, sectionally constructed (4-inches thick for Coolers, 5-inches for Freezers, 5-inches for Ceiling), of tongue and groove design with foamed-in-place gaskets (not glued, stapled, or nailed) on the male side of all interior and exterior panels.
 2. Gaskets shall be impervious to stains, greases, oils, and mildew.

3. Corner panels shall be 90-degree angles with coved corners and approximately 12-inches exterior horizontal measurements; interior partition walls shall utilize 'T' panels with coved corners.
 4. Panels shall be completely filled with rigid 100% foamed-in-place R141b blown, non-CFC urethane between interior and exterior metal 'skins' which have been die-formed and gauged for uniformity in size. Slab urethane or wood shall not be acceptable in any panel including doors, walls, floor, and ceiling.
 5. Insulation shall have a 95% closed cell structure with an average in-place density of 2.2 lbs. per cubic foot, and compression strength at yield point of 19 lbs. per square inch. Each panel shall have a thermal conductivity (K factor) of .14 BTU/hr/sq ft per degrees Fahrenheit per inch (R28 for Coolers, R36 for Freezers); and an overall coefficient of heat transfer (U factor) of not more than .035.
 6. Floor panels: Floor panels shall be die stamped with 3/8-inch radius NSF coved corners. All plane intersections shall be drawn, not cut and welded. Panels shall be fabricated similar to other panels and designed to readily withstand uniformly distributed loads of 700 lbs. per square foot.
- B. Door Construction: Walk-in coolers and freezers shall have entry and exit door hardware that complies with all of the requirements of CBC Section 11B-404.2.8.1 and maneuvering clearances at the exterior side per CBC Section 11B-404.2.4 and 11B-404.2.4.4. Doors shall be flush (in-fitting) type, self-closing, 36-inches by a minimum of 80-inches high.
1. Doors shall be mounted with three cam-lift hinges and posi-seal (hydraulic, not spring) adjustable door closers. Door hardware shall be chrome plated. Mounting height of latching hardware shall be 34 to 40 inches above finish floor. All hardware shall meet the requirements of CBC 11B-404.2.7 and 11B-309.4.
 2. Door latches shall lock and have a safety release to prevent entrapment (one quarter turn of the release handle unlocks the door from the inside).
 3. The freezer door will be provided with a low wattage (5 watts/foot) heater strip and a heated pressure relief port.
 4. Provide a solid-state electronic thermometer, pre-wired vapor proof light fixtures and pilot lights switch on each door section.
 5. The doorjambs, frames, and thresholds shall be made of durable Fiberglass Reinforced Plastic (FRP).
- C. Assembly: Panels shall be assembled by Posi-Locs or equal (no known equal), which shall be foamed-in-place and activated by a hex wrench. Floor panels shall utilize post tension construction within the floor panels. Access ports to locking devices shall be covered by snap caps and shall be located in interior of walk-in.
- D. Finishes: Refer to the Finish Schedule shown on the Foodservice Floor plan.
1. Interior and exterior surfaces (walls, ceiling and closure panels): 0.040 Stucco embossed aluminum
 2. Exposed exterior 20-gauge Type 304 stainless steel, #3 finish

3. Unexposed surfaces to be 26-gauge embossed galvanized steel
 4. Inside Floor: Verify on FS finish schedule and item specification.
- E. Accessories:
1. Provide and install .10-inch corrosion-resistant T-31 aluminum alloy diamond tread kickplates to 42-inches high on interior and exterior doors and door panels.
 2. Provide closure panels to interior ceiling and all adjacent walls, finished with 90-degree angles at the box and the ceiling/wall; no raw edges will be accepted.
 3. Provide vinyl strip curtains.
 4. Provide externally mounted digital thermometer.
 5. Per document drawings, provide 14-inches by 24-inches view port - unheated for cooler door, heated for freezer door.
- F. Insulated Floor Depressions: The FSEC shall provide styrofoam insulation for cooler and freezer floors. Insulation shall be 60 high load extruded polystyrene, 4-inch thick, with R-value, 75°F mean temperature, min 5.0/inch°F ft square h/BTU; Compressive Strength: vertical, 60.0 lb/inch square; Water Absorption maximum 0.1% by volume.
- G. Approvals: Fire hazard classification according to ASTM E-84 (UL723) shall be a flame spread rating of 25 or less with a certifying UL label attached to every panel showing the meeting of the fire code. Smoke development rating to be 450 or less; Factory Mutual approved; NSF-listed with an approved toxicity rating.
- H. Walk-in coolers and freezers shall have level maneuvering clearances at the exterior side (CBC 11B-404.2.4) and accessible entry and exit door hardware (CBC 11B-404.2.7).

2.08 REMOTE REFRIGERATION SYSTEMS

- A. Furnish and install mechanical refrigeration work as indicated and specified, complete and ready for use. Principal items of work include:
1. Mechanical refrigeration systems, including compressor units, condensers, refrigerant piping, evaporator coils, control valves, compressor racks, weather covers and required miscellaneous items.
 2. Furnishing of motor starters and walk-in refrigerator/freezer thermostats for installation under Electrical Section.
 3. Sleeves, inserts, hangers, supports and other incidental items necessary to complete the work.
 4. Cutting and patching of nonstructural and other incidental items necessary to complete the work on this section.
 5. Testing, charging, adjusting, operational testing and cleaning of equipment. Conduct all tests as required by local inspecting agencies concerned with this project.
- B. Compressors and Condensing Unit: Factory assembled, hermetic compressors with air cooled condensers operating at such speed within recommended range of section and discharge pressures for economical operation and with required BTU rating per hour, sizes and capacities in accordance with specifications. Provide units of same manufacturer and type throughout, new standard cataloged, to operate with refrigerant that meets or exceeds current Department

of Energy standards, such as R-290, R-407A, R-407C, or R-448A. Size for operation in 110 degrees Fahrenheit ambient conditions with an 80% duty cycle, capacities selected on 16 hour running time basis.

- C. Walk-In Cooler Defrost Timer Modules: Furnish and install a Grässlin FM1 STuZ (or equivalent) 24-Hour timer module with 15-minute interval captive trippers and Synchronous drive. SPDT switch shall be rated at: 21A Resistive, 2HP @ 250 VAC. To set the starting time and to provide time indication, the unit shall incorporate an authentic clock face. For override, the timer module shall contain a 3-way OFF/AUTO/ON switch. Freezer evaporator coils to include built-in electric defrost powered from remote condenser.
- D. Refrigerant Piping: Piping shall be furnished with liquid and suction refrigerant lines, condensate drain lines, thermostatic expansion valves, filter-driers, liquid-moisture indicators, heat exchangers, flexible connections, purge valves, crankcase pressure limiting valves and vibration isolators, as required.
 - 1. Copper tubing for refrigerant piping shall conform to ASTM standard specifications, serial designation B88. All piping shall be Type L ACR hard drawn copper, or cleaned and sealed soft drawn Type L copper tubing, continuous without joints, as indicated:
 - a. For exposed areas, accessible furred ceiling spaces, and in walls or excavated trench type installations, use hard-copper tubing. Exposed tubing shall be run in a manner to preclude damage by activities in the area or shall be protected by conduit. Conduit shall have water evacuated and both ends completely sealed.
 - b. For piping run in conduit through inaccessible areas, such as under slab on grade, use soft copper tubing.
 - 2. All refrigerant piping shall be properly supported by adjustable hangers spaced and adjusted as required.
 - 3. All suction and refrigerant lines shall be insulated with minimum 0.5 inch ArmaFlex or equal cellular type insulation.
 - 4. All piping at exterior of building to additionally include pipe jacket insulation to protect insulation and underlying pipe from corrosive atmospheres, physical damage, UV exposure, and water.
 - 5. Metal pipe sleeves shall be provided where piping passes through walls, ceilings or floors. Space around the tubing shall be filled with mastic insulating compound.
 - 6. All penetrations through walk-in cooler or freezer walls shall be fully insulated and sealed to be vapor tight to prevent condensation within any light fixtures, switch boxes, junction boxes, or any other fittings.
 - 7. Refrigerant and drain lines shall be fully sealed and provided with escutcheon plates by the installer.
 - 8. Install a permanent suction line filter in each compressor suction line with pressure fitting ahead of the filter to facilitate checking of the pressure drop through the filter.
 - 9. Refrigeration piping shall be carefully installed to prevent vibration from compressor pulsations.

2.09 FOOD SERVICE EQUIPMENT SCHEDULE

These items are to be provided and installed by Kitchen Equipment Contractor (KEC), unless otherwise noted. All items Not in Kitchen Equipment Contract (NIKEC) are to be provided and installed as part of the General Contract Agreement.

ITEM NO. 1 - (C.F.C.I.) MOP SINK (1 REQ'D)

NIKEC - Furnished and installed by Plumbing Contractor.

ITEM NO. 2 - (C.F.C.I.) MOP SINK FAUCET (1 REQ'D)

NIKEC - Furnished and installed by Plumbing Contractor.

ITEM NO. 3 - (C.F.C.I.) MOP BROOM HOLDER (1 REQ'D)

John Boos Model PB-MH-3

(or District approved equal)

Mop Hanger, stainless steel, with (3) rubber cam grip

ITEM NO. 4 - (C.F.C.I.) MOP SINK STORAGE WALL SHELF (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel wall shelf, minimum 16-gauge. To include: stainless steel knife brackets, 48" on center maximum. Fabricate per floor plan and detail sheets. Secure to wall with stainless steel pan head screws. Provide shop drawings for approval.

ITEM NO. 5 - (C.F.C.I.) AIR CURTAIN (1 REQ'D)

Mars Air Systems Model LPN248-1UA-OB

LoPro Series 2 Air Curtain, for 48" wide door, unheated, galvanized steel cabinet, obsidian black powder coat finish, (1) 1/6 HP motor, 115v/60/1-ph, ETL

- 1 ea. Model 99-014 Door Limit Switch, indoor, plunger/roller type, remote mounted, 1 HP max, 250v, 20.0 amps, NEMA 2

ITEM NO. 6 - (D.F.C.I.) EMPLOYEE LOCKERS (3 REQ'D)

Salsbury Industries Model 62165GY-U

(or District approved equal)

Salsbury 12" Wide Double Tier Standard Metal Locker - 1 Wide - 6 Feet High - 15 Inches Deep - Gray

- 3 ea. Model 77695GY Salsbury Compartment Shelf - for 12 Inches Wide - 15 Inch Deep Metal Locker - Gray

NOTE: to meet ADA requirements, additional shelves to be installed in lower locker compartments, no lower than 15" above the finished floor.

ITEM NO. 7 - (C.F.C.I.) WALK-IN FREEZER (1 LOT REQ'D)

Arctic Industries

Walk-in freezer with light(s), U.L. pre-fabricated insulated wall panels with NSF approved finish.

- 1 lot PANEL CONSTRUCTION: polyurethane foam insulation packed to a 2.3-lb. density with a high-density urethane perimeter. Interior cam locks to all wall, ceiling, and floor panels. Interior and exterior joints sealed by NSF approved gasket.

- 1 lot PANEL FINISHES: Interior Ceiling = 26-Gauge G90 Galvanized, Stucco Embossed, White; Interior Wall = 26-Gauge Acrylume or G90 Galvanized, Stucco Embossed; Exposed Exterior = Stainless Steel, #4 finish, w/ diamond tread wainscoting; Unexposed Exterior = 26-Gauge Acrylume or G90 Galvanized; Flooring (Freezer) = insulation only with concrete and wearing surface by others
- 1 lot PANEL ACCESSORIES: LED light fixtures. Matching vertical trim. Matching cove base. Matching closure panel. Diamond Tread Wainscoting for exposed exterior walls, 20-gauge stainless steel, +36" A.F.F.
- 1 lot DOOR FEATURES: Flush fitting, self-closing door with replaceable magnetic gasket and adjustable dual wiper blades. Hinges and locking handle with inside safety release. Hydraulic door closure, pre-wired exterior light switch, and one thermometer per compartment. Heated door opening and heated pressure relief vent for freezer only. Door quantity as shown on floor plan.
- 1 lot DOOR ACCESSORIES: Aluminum tread plate kick plates interior and exterior. Heated Triple-Pane vision panels. Plastic vinyl strip curtain.
- 1 lot Anchoring Provisions, Structural Engineering, & Stamped Drawings

ITEM NO. 8 - (C.F.C.I.) EVAPORATOR COIL, WALK-IN FREEZER (1 LOT REQ'D)

RDT Model BEL0155

Evaporator coil, serving Walk-In Freezer (Item #7). Pre-built air defrost evaporator with all necessary controls. Freezer Evaporator Coils To Include: built-in electric defrost, powered from remote condenser.

See RDT drawings for more information.

- 1 lot Provide with KE2 Evaporator Efficiency or Eco-Smart demand defrost system, (1) required per evaporator.

ITEM NO. 9 - (D.F.C.I.) WALK-IN SHELVING (1 LOT REQ'D)

Metro

(or District approved equal)

Twenty-Four (24) units of 4-tier, wire-type, mobile shelving with NSF approved epoxy coated finish and casters. Verify size and quantity with field conditions.

- 28 ea. Model 1836NK3 Super Erecta® Shelf, wire, 36"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
- 8 ea. Model 1842NK3 Super Erecta® Shelf, wire, 42"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
- 4 ea. Model 1848NK3 Super Erecta® Shelf, wire, 48"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
- 4 ea. Model 1854NK3 Super Erecta® Shelf, wire, 54"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF

- 4 ea. Model 2448NK3 Super Erecta® Shelf, wire, 48"W x 24"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
- 48 ea. Model 2454NK3 Super Erecta® Shelf, wire, 54"W x 24"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
- 96 ea. Model 63UPK3 Super Erecta® SiteSelect™ Post, 61-13/16"H, for use with stem casters, Metroseal 3 Green epoxy coated corrosion-resistant finish with Microban® antimicrobial protection
- 96 ea. Model 5PCB Super Erecta® Stem Caster, swivel (with foot operated brake), 5" dia., 1-1/4" face, 300 lb. capacity, corrosion resistant, polyurethane flat wheel tread, polymer horn, includes bumper

ITEM NO. 10 - (C.F.C.I.) WALK-IN COOLER (1 LOT REQ'D) <w/ #70>

Arctic Industries

Walk-in cooler with light(s), U.L. pre-fabricated insulated wall panels with NSF approved finish.

- 1 lot PANEL CONSTRUCTION: polyurethane foam insulation packed to a 2.3-lb. density with a high-density urethane perimeter. Interior cam locks to all wall, ceiling, and floor panels. Interior and exterior joints sealed by NSF approved gasket.
- 1 lot PANEL FINISHES: Interior Ceiling = 26-Gauge G90 Galvanized, Stucco Embossed, White; Interior Wall = 26-Gauge Acrylume or G90 Galvanized, Stucco Embossed; Exposed Exterior = Stainless Steel, #4 finish, w/ diamond tread wainscoting; Unexposed Exterior = 26-Gauge Acrylume or G90 Galvanized
- 1 lot PANEL ACCESSORIES: LED light fixtures. Matching vertical trim. Matching cove base. Matching closure panel.
- 1 lot DOOR FEATURES: Flush fitting, self-closing door with replaceable magnetic gasket and adjustable dual wiper blades. Hinges and locking handle with inside safety release. Hydraulic door closure, pre-wired exterior light switch, and one thermometer per compartment. Heated door opening and heated pressure relief vent for freezer only. Door quantity as shown on floor plan.
- 1 lot DOOR ACCESSORIES: Aluminum tread plate kick plates interior and exterior. Heated Triple-Pane vision panels. Plastic vinyl strip curtain.
- 1 lot Anchoring Provisions, Structural Engineering, & Stamped Drawings

ITEM NO. 11 - (C.F.C.I.) EVAPORATOR COIL, WALK-IN COOLER (1 LOT REQ'D)

RDT Model BEL095

Evaporator coil, serving Walk-In Cooler (Item #10). Pre-built air defrost evaporator with all necessary controls. Cooler Evaporator Coils To include: Grasslin FM1-STuZ (or equivalent) timer module with interval captive trippers and Quartz drive with 3-way switch.

See RDT drawings for more information.

- 1 lot Provide with KE2 Evaporator Efficiency or Eco-Smart demand defrost system, (1) required per evaporator.

ITEM NO. 12 - (C.F.C.I.) REFRIGERATION RACK (1 REQ'D)

RDT Model ZS1-02Z-CT3-AST

Outdoor Air-Cooled Refrigeration System (208-230/60/3). Verify location. Kitchen Equipment Contractor to run refrigeration line-sets to equipment. Electrical Contractor to provide power and control wiring to equipment. General Contractor to provide roof curb/cap, penetrations, and waterproofing. All evaporator coils to be powered through house circuit. Refrigeration system to include: coated condensers for salt-air environment and oil separator. NOTE: System is sized for a maximum line run of up to 100' (with a maximum of up to 45' vertical rise). See refrigeration drawings for more information.

1 ea. Extended Comp. Warranty

1 ea. 1-Year Labor Warranty

ITEM NO. 13 - (C.F.C.I.) CORNER GUARDS, L-SHAPE (3 REQ'D)

Custom Stainless Steel

Custom fabricated 16-gauge stainless steel corner guards at all exposed kitchen wall corners. 2"x2", from top of coved base to bottom of ceiling. Attach to wall without exposed fasteners. Verify quantity and height.

ITEM NO. 14 - (C.F.C.I.) CORNER GUARDS, U-SHAPE / WALL END CAPS (3 REQ'D)

Custom Stainless Steel

Custom fabricated 16-gauge stainless steel corner guards at all exposed kitchen wall corners. 2"x2", from top of coved base to bottom of ceiling. Attach to wall without exposed fasteners. Verify quantity and height.

ITEM NO. 15 - SPARE NUMBER

ITEM NO. 16 - (D.F.C.I.) DRY STORAGE SHELVING (1 LOT REQ'D)

Metro

(or District approved equal)

Eleven (11) units of 4-tier, wire-type, mobile shelving with NSF approved epoxy coated finish and casters. Verify size and quantity with field conditions.

4 ea. Model 1836NC Super Erecta® Shelf, wire, 36"W x 18"D, chrome plated finish, plastic split sleeves are included in each carton, NSF

4 ea. Model 1848NC Super Erecta® Shelf, wire, 48"W x 18"D, chrome plated finish, plastic split sleeves are included in each carton, NSF

36 ea. Model 1854NC Super Erecta® Shelf, wire, 54"W x 18"D, chrome plated finish, plastic split sleeves are included in each carton, NSF

44 ea. Model 63UP Super Erecta® Post, 61-13/16"H, for use with stem casters, chrome plated finish

44 ea. Model 5PCB Super Erecta® Stem Caster, swivel (with foot operated brake), 5" dia., 1-1/4" face, 300 lb. capacity, corrosion resistant, polyurethane flat wheel tread, polymer horn, includes bumper

ITEM NO. 17 - (C.F.C.I.) ICE MAKER, CUBE-STYLE (1 REQ'D)

Hoshizaki Model KM-520MAJ

(or District approved equal)

Ice Maker, Cube-Style, 22"W, air-cooled, self-contained condenser, production capacity up to 556 lb/24 hours at 70°/50° (480 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, 115v/60/1-ph, 10.6 amps, NSF, UL, ENERGY STAR®

1 ea. Model B-500SF Ice Bin, 30"W, top-hinged front-opening door, 500-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation

1 kit Model HS-2033 Top Kit, 8", ABS

ITEM NO. 18 - (C.F.C.I.) ICE BIN (1 REQ'D)

Hoshizaki Model B-500SF

Included with Ice Maker (Item #17). See Item #17 for more information.

ITEM NO. 19 - (C.F.C.I.) WATER FILTRATION SYSTEM, FOR MULTIPLE APPLICATIONS (1 REQ'D)

3M Purification Model HF160-CLS

(or District approved equal)

(5626002) 3M™ Water Filtration Products Chloramines Reduction System with Scale Inhibitor, 15-7/8"H x 4-3/8"D, 2.2 gpm, 0.2 micron, 4,700 gallons capacity, reduces bacteria, sediment, chloramines, chlorine taste & odor, cyst, scale reduction, 1/2" FNPT, NSF (for coffee/hot tea & ice applications)

ITEM NO. 19.1 - (C.F.C.I.) BACKFLOW PREVENTER (1 REQ'D)

NIKEC - Furnished and installed by Plumbing Contractor.

ITEM NO. 20 - (C.F.C.I.) HAND SINK, ADA COMPLIANT (2 REQ'D)

John Boos Model PBHS-ADA-P-STD-SSLR

(or District approved equal)

Pro-Bowl Hand Sink, wall mount, 14"W x 16" front-to-back x 5" deep bowl, (1) set of splash mount faucet holes with 4" centers, 1-7/8" drain, drain basket included, left & ride side splashes, soap & towel dispenser, removable front panel, includes mounting bracket, stainless steel construction, ADA compliant, NSF, CSA-Sanitation (Goose neck faucet included)

ITEM NO. 20.1 - (C.F.C.I.) HANDS FREE ELECTRONIC FAUCET (2 REQ'D)

T&S Brass Model EC-3105-HG

(or District approved equal)

ChekPoint™ Electronic Faucet, wall mount, 4" centers, rigid gooseneck spout, 2.2 GPM vandal resistant aerator, hydro-generator power supply, AC/DC control module with internal flow control, temperature control mixing valve with integral check valves, chrome-plated brass, flexible stainless steel supply hoses, ADA Compliant

ITEM NO. 21 - SPARE NUMBER

ITEM NO. 22 - SPARE NUMBER

ITEM NO. 23 - SPARE NUMBER

ITEM NO. 24 - (C.F.C.I.) 3-COMPARTMENT SINK (1 REQ'D)

Custom Stainless Steel

Custom fabricated, 14-gauge stainless steel 3-compartment sink with minimum (3) 20" x 28" x 14" deep basins, minimum 18" integral drainboard each side sloped to sink, and 8" high backsplash. Rear and cross rail supports to be fully welded to 1-5/8" diameter stainless steel tubular legs with adjustable bullet feet. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

- 1 ea. Furnish with (3) lever waste valve (Fisher model #22209, or equivalent) with handle support brackets welded to bottom of sink, per basin.
- 3 ea. Fisher Model 22209 DrainKing Waste Valve, with flat strainer, 12 GPM drain rate, dual teflon seals, stainless steel ball, cast red brass body

ITEM NO. 25 - (C.F.C.I.) PRE-RINSE FAUCET ASSEMBLY, WITH ADD ON FAUCET (1 REQ'D)

Fisher Model 68195

(or District approved equal)

Pre-Rinse Unit, spring, 8" backsplash mount, elbows, Add-On-Faucet with 14" swing spout, stainless steel

ITEM NO. 26 - (C.F.C.I.) WALL SHELVES (2 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel wall shelves, minimum 16-gauge. To include: stainless steel knife brackets, 48" on center maximum. Fabricate per floor plan and detail sheets. Secure to wall with stainless steel pan head screws. Provide shop drawings for approval.

ITEM NO. 27 - (C.F.C.I.) POT RACK (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel pot rack with slip-on stainless steel pot hooks, minimum every 6". Constructed of 2" X 1/4" stainless steel flat bar with 14 gauge stainless steel knife brackets, maximum 48" on center. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

ITEM NO. 28 - (C.F.C.I.) WALL SHELF (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel wall shelf, minimum 16-gauge. To include: stainless steel knife brackets, 48" on center maximum. Fabricate per floor plan and detail sheets. Secure to wall with stainless steel pan head screws. Provide shop drawings for approval.

ITEM NO. 29 - (C.F.C.I.) SOILED DISH TABLE W/ SCRAP SINK (1 REQ'D)

Custom Stainless Steel

Custom fabricated 14-gauge stainless steel soiled dish table with integral scrap sink and quick drain. To include: removable perforated sink strainer, 16-gauge stainless steel under-shelf welded to 1-5/8" stainless steel tubular legs with adjustable bullet feet. Top to be sloped to dish machine. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

ITEM NO. 30 - (C.F.C.I.) PRE-RINSE FAUCET ASSEMBLY (1 REQ'D)

Fisher Model 67997

(or District approved equal)

Pre-Rinse Unit, spring, 8" backsplash mount, with elbows, stainless steel

ITEM NO. 31 - (C.F.C.I.) QUICK DRAIN (1 REQ'D)

Custom Stainless Steel

Integral component of Soiled Dish Table (Item #29).

ITEM NO. 32 - (C.F.C.I.) DISHWASHER, DOOR TYPE (1 REQ'D)

Hobart Model AM16T-BAS-2

(or District approved equal)

Dishwasher, door type, tall chamber (27"), high temp sanitizing, 208-240/60/3 (field convertible to single phase), 60 racks/hour, straight-thru or corner, user-friendly smart touchscreen controls, Sense-A-Temp™ booster, electric tank heat, pumped rinse, pumped drain, auto-fill, stainless steel tank, frame, doors & feet, sheet pan rack, cULus, NSF, ENERGY STAR®

- 1 ea. Model WWST-STARTUP1YES Startup by Factory Trained Technician - Confirmation of correct machine and utility installation; performance check to ensure machine is operating to factory specifications; adjustments as needed, and customer demo. For installations within 100 miles of a Hobart Service Office during normal business hours with appropriate notice; beyond 100 miles contact Hobart Service. See Hobart Service for complete details
- 1 ea. Model DWT-AM16 Drain water tempering (single valve) kit with Pumped Drain Air Gap for BAS and Tall models
- 1 ea. Model ACC-INSTALL-HOB Accessory Installation - for installation within 100 miles of a Hobart Service Office during normal business hours with appropriate notice; installation beyond 100 miles will be quoted by Service. Includes installation of this item only, final electrical or plumbing connections by others. Recommendation: coordinate accessory installation with machine assembly/ installation
- 1 ea. Model DOOR-LOCK-AM16 Door lock kit – Does not allow operator to open door until cycle is finished.
- 1 ea. Model POWERSUPPLY-AM16 Power supply for AM16 Accessories
- 1 ea. Model CORNER-INST-AM16 Splash Shield for Corner Installations – Includes splash panel and sheet pan adaptor
- 1 ea. Model WTRHAMARREST-AM16 Water Hammer Arrestor – Assembly includes ¾" brass pressure regulator, pressure gauge, shock arrestor and garden hose adapter
- 1 ea. Model FLNG-FT-AM16 Flanged Feet, Bolt Down – Set of 4

ITEM NO. 33 - (C.F.C.I.) TYPE-2 STEAM EXHAUST HOOD (1 REQ'D)

Captive-Aire Model VHB-G-REM1

Custom fabricated, stainless steel Type-2 condensate hood with baffle and drip edge. Hang hood and provide stainless steel trim to ceiling with no exposed fasteners and all necessary stainless steel hood hanging materials. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

ITEM NO. 34 - (C.F.C.I.) EXHAUST FAN (1 REQ'D)

NIKEC - Furnished and installed by Mechanical Contractor.

ITEM NO. 35 - SPARE NUMBER

ITEM NO. 36 - (C.F.C.I.) CLEAN DISH TABLE (1 REQ'D)

Custom Stainless Steel

Custom fabricated 14-gauge stainless steel clean dish table. To include: 10" high backsplash along all wall edges and 16-gauge stainless steel under-shelf, welded to 1-5/8" diameter stainless steel tubular legs with adjustable bullet feet. Top to be sloped to dish machine. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

ITEM NO. 37 - (D.F.C.I.) POT & PAN SHELVING (1 LOT REQ'D)

Metro

(or District approved equal)

Five (5) units of 4-tier, wire-type, mobile storage shelving with NSF approved finish and casters. Verify size and quantity with field conditions.

20 ea. Model 1836NK3 Super Erecta® Shelf, wire, 36"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF

20 ea. Model 63UPK3 Super Erecta® SiteSelect™ Post, 61-13/16"H, for use with stem casters, Metroseal 3 Green epoxy coated corrosion-resistant finish with Microban® antimicrobial protection

20 ea. Model 5MB Super Erecta® Stem Caster, swivel (with foot operated brake), 5" dia., 1-1/4" face, 200 lb. capacity, resilient rubber flat wheel tread, includes bumper

ITEM NO. 38 - SPARE NUMBER

ITEM NO. 39 - SPARE NUMBER

ITEM NO. 40 - SPARE NUMBER

ITEM NO. 41 - (C.F.C.I.) PREP TABLE W/ DOUBLE PREP SINK, ADA ACCESSIBLE (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel prep table. To include: 6" stainless steel backsplash along all wall edges, 1-5/8" stainless steel tubular legs with fully welded cross bracing and adjustable bullet feet. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

2 ea. Integral 20" x 20" x minimum 6" deep prep sink basin

ITEM NO. 42 - (C.F.C.I.) FAUCET (1 REQ'D)

Fisher Model 57665

(or District approved equal)

Faucet, deck mount, 8" centers, 12" swing spout, lever handles with color coded indexes, 1/2" male inlets, stainless steel, ADA Compliant

ITEM NO. 43 - (C.F.C.I.) WALL SHELF (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel wall shelf, minimum 16-gauge. To include: stainless steel knife brackets, 48" on center maximum. Fabricate per floor plan and detail sheets. Secure to wall with stainless steel pan head screws. Provide shop drawings for approval.

ITEM NO. 44 - (C.F.C.I.) WORK TABLE, ADA ACCESSIBLE (1 REQ'D)

Custom Stainless Steel

Custom fabricated 16-gauge stainless steel ADA accessible prep table with open base. To include: 6" backsplash along all wall edges. Side and rear cross-rails to be constructed of 1-5/8" diameter stainless steel tubing, fully welded to 1-5/8" stainless steel tubular legs with adjustable bullet feet. Fabricate with a minimum 19" clearance depth and minimum 42" clearance width under table. Fabricate per floor plan and detail sheets. Provide shop drawings for approval

ITEM NO. 45 - (D.F.D.I.) MOBILE HEATED CABINET (2 REQ'D)

Cres Cor Model H137SUA12D

(or District approved equal)

Cabinet, Mobile Heated, insulated, top-mount heater assembly, recessed push/pull handles, magnetic latch, (12) sets chrome plated wire universal angle slides for 12" x 20" thru 18" x 26" pans on 4-1/2" centers, adjustable 1-1/2" centers, reversible dutch doors, (4) heavy duty 5" swivel casters (2) braked, anti-microbial latches, stainless steel construction, NSF, cCSAus, ENERGY STAR®

2 ea. 120v/60/1-ph, 1.5 kW, 12.0 amp, 10 ft power cord, NEMA 5-15P, standard

12 set Model 0621 281 K Extra Universal Angles (set of 2)

2 ea. Right-hand door swing (top & bottom doors), standard

4 ea. Key lock handles (per door) (2 required)

ITEM NO. 46 - (C.F.C.I.) ISLAND PREP TABLE W/ INTEGRAL PREP SINK (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel prep table. To include: 6" stainless steel backsplash along all wall edges and stainless steel fixed under-shelf welded to 1-5/8" stainless steel tubular legs with fully welded cross bracing and adjustable bullet feet. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

1 ea. Integral 20" x 20" x minimum 12" deep prep sink basin (meets EHP-883)

3 ea. Provide with drawer(s), size quantity and location per drawings and detail sheets.

ITEM NO. 47 - (C.F.C.I.) FAUCET (1 REQ'D)

Fisher Model 57665

(or District approved equal)

Faucet, deck mount, 8" centers, 12" swing spout, lever handles with color coded indexes, 1/2" male inlets, stainless steel, ADA Compliant

ITEM NO. 48 - (D.F.D.I.) MICROWAVE OVEN (1 REQ'D)

Panasonic Model NE-1054F

(or District approved equal)

PRO Commercial Microwave Oven, 1000 watts, 0.8 cu. ft. capacity, (6) power levels, 2- & 3-stage cooking, 20 program memory capacity, touch control pad with Braille, 99-minute timer, programmable and manual operation, program list/cycle counter, self-diagnostics, tone control, bottom energy feed, interior light, see-through door with "grab & go" handle, stainless steel front, 120v/60/1-ph, 13.4 amps, cord, NEMA 5-15P, cULus, NSF

ITEM NO. 49 - (D.F.D.I.) BUN / SHEET PAN RACK (2 REQ'D)
GSW USA Model AAR-2022W
(or District approved equal)
Bun Pan Rack, open sides, (20) 18" x 26" pan capacity, 2-1/2" spacing, welded angle slides, 6" casters (2) with brake, all welded 1" aluminum tubing, ETL

ITEM NO. 50 - SPARE NUMBER

ITEM NO. 51 - SPARE NUMBER

ITEM NO. 52 - SPARE NUMBER

ITEM NO. 53A - (D.F.C.I.) CONVECTION OVEN, DOUBLE-DECK, GAS (1 REQ'D)

Blodgett Model ZEPH-200-G-ES DBL

(or District approved equal)

Zephaire Convection Oven, gas, double-deck, bakery depth, capacity (5) 18" x 26" pans per compartment, (SSI-D) solid state infinite controls with digital timer, two speed fans, porcelainized baking compartments, dependent glass doors, interior light, flue connector, stainless steel front, sides and top, 6" stainless steel legs, 50,000 BTU each, cETLus, CE, NSF, ENERGY STAR®

1 ea. Natural gas

2 ea. 115v/60/1-ph, 8.0 amps, 2-wire with ground, cord & plug, 3/4 hp (per deck), standard

1 ea. Model SSI-D Top Oven: Solid State infinite with digital timer, standard

1 ea. Model SSI-D Bottom Oven: Solid State infinite with digital timer, standard

1 set 4" low profile plate casters (set)

ITEM NO. 53B - (D.F.C.I.) CONVECTION OVEN, GAS (1 REQ'D)

Blodgett Model ZEPH-200-G-ES

Included with Double-Stacked Convection Ovens (Item #53A). See Item #53A for more information.

ITEM NO. 54A - (D.F.C.I.) CONVECTION OVEN, DOUBLE-DECK, GAS (1 REQ'D)

Blodgett Model ZEPH-200-G-ES DBL

(or District approved equal)

Zephaire Convection Oven, gas, double-deck, bakery depth, capacity (5) 18" x 26" pans per compartment, (SSI-D) solid state infinite controls with digital timer, two speed fans, porcelainized baking compartments, dependent glass doors, interior light, flue connector, stainless steel front, sides and top, 6" stainless steel legs, 50,000 BTU each, cETLus, CE, NSF, ENERGY STAR®

1 ea. Natural gas

2 ea. 115v/60/1-ph, 8.0 amps, 2-wire with ground, cord & plug, 3/4 hp (per deck), standard

1 ea. Model SSI-D Top Oven: Solid State infinite with digital timer, standard

1 ea. Model SSI-D Bottom Oven: Solid State infinite with digital timer, standard

1 set 4" low profile plate casters (set)

ITEM NO. 54B - (D.F.C.I.) CONVECTION OVEN, GAS (1 REQ'D)

Blodgett Model ZEPH-200-G-ES

Included with Double-Stacked Convection Ovens (Item #54A). See Item #54A for more information.

ITEM NO. 55 - (D.F.C.I.) TILTING SKILLET BRAISING PAN, GAS (1 REQ'D)

Groen Model BPM-30GC

(or District approved equal)

Braising Pan, gas, 30-gallon capacity, 10" deep pan, 38" pan height, IPX6 water rated electronic Classic controls, manual tilt, standard etch marks, faucet bracket, round tubular open leg base, stainless steel construction, bullet feet, electric spark ignition, 104,000 BTU/hr, cCSAus, NSF, IPX6, Made in USA

1 ea. 115v/60/1-ph, 5.0 amps, standard

1 ea. Natural gas

1 ea. Model ELEVO-2000 For elevation between 0 and 2000 (When order is placed, all equipment with elevation specified will be assigned a different Part# by the factory)

1 ea. 2" Tangent draw-off with perforated strainer

1 ea. Model 159102 Drain cup & 8' hose assembly for TDO

1 ea. Model Z079995 Lip Strainer, for tilting braising pans

1 ea. Model 147150 Steamer Insert Kit - 2 stacking racks, (2) perforated pans with covers, (1) pan lifter ((1) for 15 gal - max (2) kits per 30 or 40 gal braising pan)

1 ea. Model 150247 Pan Carrier, universal style, fits all size and type braising pans (except TD/FPC, BPM-15E, BPM-15G)

1 ea. Model Z091870 Faucet, double pantry, with swing spout

1 ea. Model FL FOOTKIT 4 Flanged Feet, for all BPM & BPP models (set of 4)

ITEM NO. 56 - (C.F.C.I.) FLOOR TROUGH (1 REQ'D)

Custom Stainless Steel

Custom fabricated stainless steel floor trough with removable grates. See detail sheets for type and design. Fabricate per floor plan and detail sheets. Verify size and location requirements with equipment manufacturer's specification sheets. Coordinate location to be installed with Plumbing and General Contractors. Provide shop drawings for approval.

ITEM NO. 57 - (D.F.C.I.) 6-BURNER RANGE W/ CONVECTION OVEN BASE (1 REQ'D)

Montague Company Model V136-5

(or District approved equal)

Legend™ Heavy Duty Range, gas, 36", (6) 12" 30,000 BTU open burners, convection oven base, stainless steel front & 4" flue riser, black sides, 6" high adjustable stainless steel legs, 220,000 BTU, NSF, cETLus, CE

1 ea. Natural gas

1 ea. 120v/60/1ph, std.

1 ea. 1" Left rear manifold with pressure regulator (up to 500,000 BTU/hr)

1 ea. Cap & stainless steel manifold cover, left

- 1 ea. Cap & stainless steel manifold cover, right
- 1 ea. Sides, stainless steel for range
- 1 ea. Exterior bottom, 304 stainless steel for range
- 1 ea. Back, stainless steel for range
- 1 ea. Piezo Ignitor (oven only)
- 1 ea. Stainless steel burner box assembly, includes all stainless steel bottom, drip tray, drip tray glides, deflector shields & burner supports (beneath open tops and/or ribbon grates)
- 1 ea. Casters with 5" wheel 6" OA (set of 4)

ITEM NO. 58 - SPARE NUMBER

ITEM NO. 59 - SPARE NUMBER

ITEM NO. 60 - SPARE NUMBER

ITEM NO. 61 - (C.F.C.I.) TYPE-1 GREASE EXHAUST HOOD (1 REQ'D)

Captive-Aire Model ND-2

Type-1 grease exhaust hood, UL or ETL listed. Includes stainless steel baffle filters. Furnish per floor plan, detail sheets, and specifications. Field verification required. Hang hood and provide stainless steel trim to ceiling with no exposed fasteners and all necessary stainless steel hood hanging materials. Provide shop drawings for approval.

ITEM NO. 62 - (C.F.C.I.) EXHAUST FAN FOR EXHAUST HOOD (1 REQ'D)

NIKEC - Furnished and installed by Mechanical Contractor.

ITEM NO. 63 - (C.F.C.I.) MAKE-UP AIR SYSTEM (1 REQ'D)

NIKEC - Furnished and installed by Mechanical Contractor.

ITEM NO. 64 - (C.F.C.I.) WALL METAL/FLASHING (1 LOT REQ'D)

Custom Stainless Steel

Custom fabricated 20-gauge stainless steel wall metal. From top of cove base to bottom of hood. Install with hem clips and without visible fasteners. Fabricate per floor plan and detail sheets. Provide shop drawings for approval.

- 1 lot Include custom fabricated, minimum 20 gauge, stainless steel hood skirt from top of hood to ceiling with knuckle type connections (no laps) and access panel, where necessary. Install with hem clips and without visible fasteners.

ITEM NO. 65 - (C.F.C.I.) QUICK GAS DISCONNECTS (1 LOT REQ'D)

T&S Brass

(or District approved equal)

Verify size and quantity with equipment.

- 1 kit Model HG-4C-48K Safe-T-Link Gas Connector Kit, 1/2" connection, 48" hose, stainless steel braiding with extruded coating, (1) Quick-Disconnect, (1) street "EL", ball valve, restraining cable adjustable for 3'to 5', 70,000 BTU / hr minium flow capacity

- 4 kit Model HG-4D-48K-PS Safe-T-Link Gas Connector Hose, 3/4" connection, 48" hose, stainless steel braiding with extruded coating, (1) Quick-Disconnect, with Posi-Set locating devices, street elbow, extruded stainless steel braidings, 180,000 BTU / hr minimum flow capacity, NSF, cCSAus
- 1 kit Model HG-4E-48K-PS Safe-T-Link Gas Connector Kit, 1" connection, 48" hose, stainless steel braiding with extruded coating, (1) Quick-Disconnect, (1) street "EL", ball valve, restraining cable adjustable for 3'to 5' & Posi-Set, 335,000 BTU / hr minimum flow capacity

ITEM NO. 66 - (C.F.C.I.) FIRE SUPPRESSION SYSTEM (1 LOT REQ'D)

Ansul Fire Protection Model R-102

Ansul: Wall Mounted Fire Suppression System. Design and installation of the kitchen hood fire suppression system. All equipment to be installed in a professional manner, in compliance with NFPA 96, 17A, UL 300 and local fire code requirements. Provide labor and materials for the complete installation and testing of one (1) lot Ansul automatic fire suppression system to protect the exhaust hoods and appliances based on a plan review, equipment and services to include the following: Tanks in stainless steel enclosures; UL listed grease seal adapters; Pipe, nozzles, fittings, conduit in chrome; Fusible link detectors; Double throw micro-switches (4PDT); Manual Pull Station; Plan drawings and submittal pkg.; Final acceptance test w/Local authorities.

- 1 lot Gas shut-off valve to be furnished by K.E.C., installed by Plumbing Contractor.
- 1 lot Electrical Contractor is responsible for wiring main control panel, all fans per included schematic & shunt trip breaker

ITEM NO. 67 - (C.F.C.I.) REMOTE PULL STATION FOR FIRE SUPPRESSION SYSTEM (1 REQ'D)

Ansul Fire Protection

Furnished and installed by Kitchen Equipment Contractor. Octagonal junction box to be roughed-in by Electrical Contractor.

ITEM NO. 68 - (C.F.C.I.) K-TYPE FIRE EXTINGUISHER (1 REQ'D)

Ansul Fire Protection

Furnished by Kitchen Equipment Contractor. Installed by General Contractor.

ITEM NO. 69 - (C.F.C.I.) GAS SHUT-OFF VALVE (1 REQ'D)

Ansul Fire Protection

Furnished by Kitchen Equipment Contractor. Installed by Plumbing and Electrical Contractors, as required.

ITEM NO. 70 - HOOD CONTROLS, WALL MOUNT CONTROL CABINET (1 REQ'D)

Captive-Aire Model DCV-1011

See Captive-Aire hood drawings for more information.

ITEM NO. 71 - SPARE NUMBER

ITEM NO. 72 - SPARE NUMBER

ITEM NO. 73 - (D.F.C.I.) PASS-THRU REFRIGERATOR (2 REQ'D)

Victory Refrigeration Model RS-2D-S1-PT-HC

(or District approved equal)

UltraSpec™ Series Refrigerator, Pass-thru, two-section, self-contained refrigeration, 48.33 cu. ft. capacity, (4) full height solid hinged doors, (6) silver freeze (chrome-style) shelves, stainless exterior & interior, standard depth cabinet, TOUCH POINT™ electronic temperature control/indicator, LED lighting, expansion valve technology, Santoprene door gaskets with 2 year warranty, stainless steel breakers, R290 Hydrocarbon refrigerant, 1/3 HP, cULus, UL EPH Classified, UL-Sanitation, MADE IN USA

- 2 ea. Self-Contained refrigeration
- 2 ea. 115v/60/1-ph, 6.5 amps, with cord & NEMA 5-15P
- 2 ea. Control/Kitchen side door hinging: left door hinged on left, right door hinged on right standard
- 2 ea. Rear/Server side door hinging: left door hinged on left, right door hinged on right standard
- 20 ea. Model 10601201S Type "A/C" Tray Slide Pair, 1 tray slide set for (1) 18" x 26" or (2) 14" x 18" or (2) 12" x 20" Pans
- 2 ea. Stainless steel case back - with stainless steel rear air grille, for reach-in models
- 2 ea. Model 00C31-055A 6" Seismic Legs (set of 4)

ITEM NO. 74 - (D.F.C.I.) PASS-THRU HEATED CABINET (2 REQ'D)

Cres Cor Model H137PSUA12D

(or District approved equal)

Cabinet, Mobile Heated, pass-thru, insulated, top-mount heater assembly, solid state electronic control with digital display, (12) sets of chrome plated wire universal angle slides adjustable on 4-1/2" centers adjustable 1-1/2" centers, field reversible dutch door, anti-microbial magnetic door latches, (4) 5" swivel casters (2) braked, stainless steel construction, NSF, cCSAus

- 2 ea. 120v/60/1-ph, 2.0 kW, 16 amp, standard
- 12 set Model 0621 281 K Extra Universal Angles (set of 2)
- 2 ea. Right-hand door swing for front door (top & bottom), standard
- 2 ea. Right-hand door swing for rear doors (top & bottom), standard
- 8 ea. Key lock handles (per door) (4 required)
- 2 set 6" bolt down leg, set of 4

ITEM NO. 75 - (D.F.C.I.) CASH REGISTER STAND (3 REQ'D)

G.A. Systems Inc. Model D3136A

(or District approved equal)

Cashier Stand Cabinet, 31-1/8"W x 36-3/8"D x 34"H, open understorage, (1) locking pin, stainless steel trim, galvanized steel body, (4) 3" plate non-marking swivel casters with brakes, ADA Compliant, ETL-Sanitation

- 3 ea. High pressure laminate exterior finish, available in custom colors - contact factory for color options

ITEM NO. 76 - (D.F.D.I.) P.O.S. SYSTEM & CARD READERS (3 REQ'D)
NIKEC - Furnished and installed by District.

ITEM NO. 77 - (D.F.C.I.) SERVING COUNTER, COLD FOOD (3 REQ'D)
G.A. Systems Inc. Model C5
(or District approved equal)

Speedee Serv® Speedline Refrigerated Serving Cabinet, 63-3/16"W x 30-3/8"D x 34"H, bottom-mounted self-contained refrigeration (Refrigerated Snap In), 16/304 stainless steel top, holds (12) 4" deep or (24) 2" deep baskets, (2) aluminum sliding lids with locking bar, (2) locking pins, removable louvered front access panel, hot gas condensate evaporator, stainless steel interior & trim, galvanized body, (4) 3" plate non-marking swivel casters with brakes, R134a refrigerant, ADA Compliant, cULus, ETL-Sanitation

3 ea. 120v/60/1-ph, 1/3 HP, cord with NEMA 5-15P, standard

3 ea. High pressure laminate exterior finish, available in custom colors - contact factory for color options

36 ea. Model B13204S Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, stainless steel wire construction

ITEM NO. 78 - (D.F.C.I.) HOT FOOD SERVING COUNTER / TABLE (3 REQ'D)
G.A. Systems Inc. Model H5
(or District approved equal)

Speedee Serv® Speedline Heated Serving Cabinet, 63-3/16"W x 30-3/8"D x 34"H, 16/304 stainless steel top, (2) sliding lids with locking bar, holds (12) 4" deep or (24) 2" deep baskets, includes: (2) locking pins, stainless steel interior & trim, galvanized body, (4) 3" plate non-marking swivel casters with brakes, ADA Compliant, ETLus, ETL-Sanitation

3 ea. 120v/60/1-ph, 2700 watts, 22.0 amps, cord with NEMA 5-30P, standard

3 ea. High pressure laminate exterior finish, available in custom colors - contact factory for color options

36 ea. Model B13204S Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, stainless steel wire construction

ITEM NO. 79 - (D.F.C.I.) SNEEZE GUARD, STATIONARY (3 REQ'D)
G.A. Systems Inc. Model DSN6330G
(or District approved equal)

Quick Click Adjustable Sneeze Guard, 63"W x 29"D x 22"H, double-sided, top mount, 1" round stainless steel tubing with brushed finish, 3/8" thick tempered glass with polished edges, independent angular adjustable, includes: hardware, ETL-Sanitation

ITEM NO. 80 - (D.F.C.I.) SERVING COUNTER, COLD FOOD (3 REQ'D)
G.A. Systems Inc. Model C5
(or District approved equal)

Speedee Serv® Speedline Refrigerated Serving Cabinet, 63-3/16"W x 30-3/8"D x 34"H, bottom-mounted self-contained refrigeration (Refrigerated Snap In), 16/304 stainless steel top, holds (12) 4" deep or (24) 2" deep baskets, (2) aluminum sliding lids with locking bar, (2) locking pins, removable louvered front access panel, hot gas condensate evaporator, stainless steel interior & trim, galvanized body, (4) 3" plate non-marking swivel casters with brakes, R134a refrigerant, ADA Compliant, cULus, ETL-Sanitation

- 3 ea. 120v/60/1-ph, 1/3 HP, cord with NEMA 5-15P, standard
- 3 ea. High pressure laminate exterior finish, available in custom colors - contact factory for color options
- 36 ea. Model B13204S Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, stainless steel wire construction

ITEM NO. 81 - (D.F.C.I.) MILK COOLER (3 REQ'D)

Beverage Air Model ST34HC-S

(or District approved equal)

School Milk Cooler, cold wall, normal temperature, 34"W x 31-1/4"D x 41-1/8"H, 12.37 cu. ft., dual access, flat top carton capacities, (8) 13" x 13" x 11" or (4) 19" x 13" x 11 case capacities, self-latching doors/lids with safety bumpers, cylinder lock, wire floor racks, electronic control, auto defrost, stainless steel interior & exterior, R290 Hydrocarbon refrigerant, 1/2 HP, cULus, UL EPH Classified, UL-Sanitation, Made in USA

- 3 ea. 115v/60/1-ph, 4.0 amps, standard
- 3 ea. 4" Heavy duty casters, (2) with brakes, standard

ITEM NO. 82 - (C.F.C.I.) AIR CURTAIN (6 REQ'D)

Mars Air Systems Model LPN236-1UA-OB

(or District approved equal)

LoPro Series 2 Air Curtain, for 36" wide door, unheated, galvanized steel cabinet, obsidian black powder coat finish, (1) 1/6 HP motor, 115v/60/1-ph, ETL

- 6 ea. Model 99-014 Door Limit Switch, indoor, plunger/roller type, remote mounted, 1 HP max, 250v, 20.0 amps, NEMA 2

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine roughing-in for piping, mechanical, and electrical systems to verify actual locations of connections before installation.

3.02 INSTALLATION, GENERAL

- A. Install food service equipment level and plumb, according to manufacturer's written instructions, original design, and referenced standards.
- B. Complete equipment field assembly, where required, using methods indicated.
 - 1. Provide closed butt and contact joints that do not require a filler.
 - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "Fabrication, General" Article.
- C. Install equipment with access and maintenance clearances according to manufacturer's written instructions and requirements of authorities having jurisdiction.

- D. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.
- E. Except for mobile and adjustable-leg equipment, securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- F. Install cabinets and similar equipment on concrete or masonry bases in a bed of sealant.
- G. Install hoods to comply with NFPA 96 requirements and to remain free from vibration when operating.
- H. Install seismic restraints according to referenced SMACNA standard.
- I. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches (1200 mm) on center, maximum.
- J. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

3.03 PROTECTING

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensures food service equipment is without damage or deterioration at the time of Substantial Completion.

3.04 COMMISSIONING

- A. Startup Services: Engage factory-authorized service representatives to perform startup services and to demonstrate and train Owner's/School District's maintenance personnel as specified below.
 1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized.
 2. Remove protective coverings and clean and sanitize equipment, both inside and out, and re-lamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.
 3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.
 4. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.
 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 6. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
 7. Test water, drain, gas, steam, oil, refrigerant, and liquid-carrying components for leaks. Repair or replace leaking components.
 8. Train Owner's/School District's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance for each food service equipment item.

9. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Closeout Requirements".
10. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data".
11. Schedule training with Owner/School District Representative, through Architect, with at least 7 days' advance notice.

END OF SECTION

**SECTION 11 47 00
ICE MACHINES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ice Machines
- B. Connections to utilities.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants.
- B. Division 22 - Plumbing Piping: Water supply, and sanitary drainage and vent piping and specialties.
- C. Division 22 - Plumbing Fixtures: Faucets and fittings; specialty food service fixtures.
- D. Division 26 - Equipment Wiring: Rough in and wiring of electrical equipment to building distribution.

1.03 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2001 (R2005).
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2005).
- C. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2006.
- D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.
- E. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2009.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- G. NSF 2 - Food Equipment; NSF International; 2009.
- H. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines; 2001.
- I. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene four weeks before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each manufactured product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

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- 4. Configuration, sizes, materials, finishes, locations, utility connections and locations.
- C. Samples: For each finish product specified that requires color selection, minimum size 6 inches square, representing actual product, color, and patterns.
- D. Certificates: Certify that products of this section meet or exceed specified requirements.
- E. Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Project Record Documents: Record actual locations of utility connections.
- G. 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.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.
- I. Extra Materials:
 - 1. Under Counter Ice Machine: Provide two extra filters for use by District
 - a. Provide two extra filters for use by District
 - b. Provide two containers of Cleaning and Sanitizing solutions for use by District

1.06 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of commercial food services equipment with minimum three years documented experience and NSF certified for the type of equipment specified.

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 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work of this section within a five year period after Date of Substantial Completion.
- C. Undercounter Ice Machine
 - 1. Provide three year manufacturer parts and labor warranty for replacement or repair of undercounter equipment, refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit.
- D. Free Standing Ice Machine

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1. Provide five year manufacturer parts and labor warranty for replacement or repair of evaporator including disconnection and removal of defective unit, and connection of replacement unit.
2. Provide five year manufacturer parts warranty for replacement of compressor and condenser, including removal of defective unit, and connection of replacement unit.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Free Standing Ice Machine and Storage Bin:

1. Basis of Design Manufacturer :
 - a. Manitowac, Inc.; Product Indigo Series 1000 Ice Cube Machine Model IY-1004A with B-570 Storage Bin: www.manitowocice.com.
 - b. Acceptable Manufacturers:
 - 1) Scotsman Ice Systems, Inc.; Product C0830SR-32A Prodigy Ice Machine with B530S Storage Bin: www.scotsman-ice.com.
 - 2) None Listed.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
2. All Equipment Eligible for Energy Star Rating: Energy Star Rated.
3. Electrical Wiring and Components and Self-Contained Refrigeration Systems: Conform to UL standards.
4. Cuber: Small cubes, 7/8 inch x 7/8 inch x 3/8 inch.
5. Capacity: Greater than 700 lbs in 24 hours. 90 degree air/ 70 degree water
6. Electrical Requirements: 208-230V, 20A, single phase, dedicated circuit.
7. Plumbing Requirements:
 - a. Input: 3/8 inch FPT, 20-100 PSI.
 - b. Drain: 3/4 inch FPT
8. Water Filter: in-line type on input line.
 - a. Pre-Filter.
 - b. Fine Filter.
9. Finish: Stainless Steel.
10. Water Filter: Included, see Extra Materials in Submittals above.
11. Cleaning and Sanitizing Solutions: Included, see Extra Materials in Submittals above.
12. Ice Machine Accessories:
 - a. Bin Ice-Level Control
 - b. Growth inhibitor to reduce yeast and bacteria.
 - c. Automatic routine ice machine cleaning device.
13. Certification: NSF, AHRI, ISO 9001:2000.

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14. Storage Bin Application Capacity: 420 lbs. ARI certified.
 15. Storage Bin Interior: Stainless Steel.
 16. Storage Bin Drain Type: Gravity.
 17. Dimensions (overall in inches): 22W x 34 D x 76.5-79 H.
 - a. Ice Machine: 30 W x 24 D x 26.5-29 H.
 - b. Storage Bin: 30 W x 34 D x 44 H (plus 6 inch legs).
 - c. Clearances: 6 inches on rear and each side for ventilation.
 18. Door Clearance: 12 inches minimum.
 19. Storage Bin Accessories:
 - a. 6 inch stainless steel leg kit.
 - b. Bagger, hook on bin.
 - c. Scoop Holder, stainless steel.
- B. Installation Accessories: Provide all rough-in hardware, supports and connections, attachment devices, closure trim, and accessories required for complete installation.
- C. Provide insulated indirect waste line to floor sink.

2.02 FABRICATION

- A. Install rubber button feet on bearing surface of any item positioned on a finished surface.
- B. Isolate rotating or reciprocating machinery to prevent noise and vibration.
- C. Provide indirect drain piping from equipment to terminate over nearest waste receptor.
- D. Accommodate site installation of other services or equipment.

2.03 FINISHES

- A. All Components: Shop finish.
- B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply minimum two coats factory baked epoxy, color as selected.
- C. Stainless Steel: No. 4 finish.

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 that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install items in accordance with manufacturers' instructions.

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- 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. Follow SMACNA seismic restraint recommendations for project location.
- F. Make sanitary joints between equipment and flashings and adjacent walls, floor, and ceiling, in accordance with Section 07 9005.

3.03 ADJUSTING

- A. Adjust equipment and apparatus to ensure proper working order and conditions.
- B. Remove and replace equipment creating excessive noise or vibration.

3.04 CLEANING

- A. Remove masking or protective covering from stainless steel and other finished surfaces.
- B. Wash and clean equipment.
- C. 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 District 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

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**SECTION 12 24 00
WINDOW SHADES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior motorized roller shades, battery powered for ADA. RS-1
- B. Motor controls.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

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. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- D. NFPA 70 - National Electrical Code.
- E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- F. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- B. 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.
- 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.

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- 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.
 - 1. Motorized Shades: Include finish selections for controls.
- 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 District'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.

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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. Electric Motors: One year.
 - 3. Electronic Control Equipment: One year.
 - 4. Fabric: One year.
 - 5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Motorized Roller Shades, Motors and Motor Controls:
 - 1. Draper, Inc; FlexShade ReCharge: www.draperinc.com/#sle.
 - 2. Levolor: www.levolor.com/commercial/#sle.
 - 3. MechoShade Systems LLC; UrbanShade Single Roller - Motorized: www.mechoshade.com/#sle.
 - 4. Skyco Shading; www.skycoshade.com.
 - 5. 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. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
 - a. Comply with NFPA 70.
 - b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
 - c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.
- B. Roller Shades:
 - 1. Description - Interior Roller Shades: Single roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
 - a. Drop Position: Regular roll.

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- 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.
 - b. 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.
 5. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.
 - b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.
- C. Interior Roller Shades - Basis of Design: Draper, Inc; FlexShade Recharge: www.draperinc.com/#sle.
1. Description: Single roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
 - a. Drop Position: Regular roll.
 - b. Mounting: Wall mounted.
 - c. Size: As indicated on drawings.
 - d. Fabric: As indicated under Shade Fabric article.
 2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Hardware Type: Universal brackets.
 3. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
 4. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
 - a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.

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- c. Fabric Attachment: Utilize double-sided adhesive tape.
 - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
5. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
 - a. Style: Closed pocket; aluminum elliptical slat inside pocket with heat-sealed ends.
 6. Shade Motor: Battery-operated radio technology (wireless) motor with integral lithium-ion battery rechargeable via 12V power adapter or solar panel.
 7. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; clear anodized finish.
 - b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.
- D. Roller Shades - Basis of Design: MechoShade Systems LLC; UrbanShade Single Roller - Motorized, with wireless control ; www.mechoshade.com/#sle.
1. Description: 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:
 - 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.
 - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
 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. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
 - 1) Profile: Square.

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- 2) Configuration: Captured, fascia stops at captured bracket end.
- b. 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.
 - b. Mermet Corporation; E-Screen - 5%: www.mermetusa.com/#sle.
 - c. Phifer, Inc; Style 2390 5%: www.phifer.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 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.

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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.
- 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. 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.
 - d. Products:
 - 1) Draper, Inc.: C156.260 Recharge RF 15 Channel Remote: www.draperinc.com/#sle
 - 2) MechoShade Systems LLC; RTS Transmitter Remote EIRC-0632-RA-TR, EIRC-0633-RA-TR: www.mechoshade.com/#sle.

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.

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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. 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 District's personnel.
- C. Training: Train District'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 District.

3.07 PROTECTION

- A. Protect installed products from subsequent construction operations.

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- 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 District, a proposal as an alternate to the base bid, 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

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**SECTION 12 36 00
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinetwork. PL-3, SSM-1
- B. Wall-hung counters.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 41 00 - Architectural Wood Casework.

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.
- 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.

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- 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. Comply with WI (MCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.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. Provide a Woodwork Institute Certified Compliance Label on each Plastic Laminate, Solid Surface, and Solid Phenolic Core countertop.
 - 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.

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

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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.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. PL-3 Basis of Design Product: Standard HPL as manufactured by Wilsonart, or approved equal.
 - b. Manufacturers:
 - 1) Formica Corporation: www.formica.com.
 - 2) Lamin-Art, Inc: www.laminart.com.
 - 3) Panolam Industries International, Inc.\Nevamar: www.nevamar.com.
 - 4) Panolam Industries International, Inc.\Pionite: www.pionitelaminates.com.
 - 5) Wilsonart: www.wilsonart.com.
 - 6) 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. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - f. Finish: Matte or suede, gloss rating of 5 to 20.
 - g. Surface Color and Pattern: As indicated on drawings.
 - 2. Back and End Splashes: Same material, same construction.
 - 3. 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

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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: Corian as manufactured by Dupont, or approved equal.
 - b. Manufacturers:
 - 1) Avonite Surfaces: www.avonitesurfaces.com.
 - 2) Dupont: www.corian.com.
 - 3) Formica Corporation: www.formica.com.
 - 4) Wilsonart: www.wilsonart.com.
 - 5) 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.

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.

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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.

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- C. Field Joints: 1/8 inch wide, maximum.
 - 1. Joints between backsplashes and countertops: Seal joints with silicone sealer.
 - 2. Joints Between Adjacent Pieces of Quartz Surfacing:
 - a. Joints shall be flush, tight fitting, level, and neat.
 - b. Securely join with stone adhesive. Fill joints level with quartz surfacing.
 - c. Clamp or brace quartz surfacing in position until adhesive sets.

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.

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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. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- C. 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.
 - 5. Proco Products, 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.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Presealed Systems.
- 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 (34.5-MPa), 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 (25-mm) 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 (50 mm) 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 (6.4-mm) 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 07 92 00 "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 07 84 13 "Penetration 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 (DN 150): Galvanized-steel-pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Interior Partitions:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.

END OF SECTION

SECTION 22 05 18
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

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.

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 type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Liquid-in-glass thermometers.
 - 3. Thermowells.
 - 4. Dial-type pressure gages.
 - 5. Test plugs.
- B. Related Sections:
 - 1. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
 - 2. Division 22 Section " Domestic Water Piping" for water meters inside the building.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Trerice, H. O. Co.
 - 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 3. Weiss Instruments, Inc.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C).
- E. Connector Type(s): Union joint, rigid, back and rigid, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.

- G. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.02 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Terrice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Or approved equal.
 2. Standard: ASME B40.200.
 3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
 4. Case Form: Straight unless otherwise indicated.
 5. Tube: Glass with magnifying lens and blue or red organic liquid.
 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
 7. Window: Glass.
 8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.03 THERMOWELLS

- A. Thermowells:
 1. Standard: ASME B40.200.
 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 3. Material for Use with Copper Tubing: CNR.
 4. Material for Use with Steel Piping: CRES.
 5. Type: Stepped shank unless straight or tapered shank is indicated.
 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
 7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 8. Bore: Diameter required to match thermometer bulb or stem.

9. Insertion Length: Length required to match thermometer bulb or stem.
 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.04 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - c. Weiss Instruments, Inc.
 2. Standard: ASME B40.100.
 3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 6. Movement: Mechanical, with link to pressure element and connection to pointer.
 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
 8. Pointer: Dark-colored metal.
 9. Window: Glass.
 10. Ring: Metal.
 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.05 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Terice, H. O. Co.
 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 3. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
- L. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.

3.02 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
 - 1. Liquid-filled, bimetallic-actuated type.
 - 2. Direct-mounted, metal-case, vapor-actuated type.
 - 3. Industrial-style, liquid-in-glass type.
 - 4. Direct-mounted, light-activated type.
 - 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

3.06 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
 - 1. Liquid-filled, direct -mounted, metal case.
 - 2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
 - 1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
 - 2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
 - 1. Liquid-filled, direct-mounted, metal case.
 - 2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).
- B. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Equipment supports.
- B. Related Sections:
 - 1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 22 05 16 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 3. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.02 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.
 - b. Flex-Strut Inc.
 - c. Unistrut Corporation; Tyco International, Ltd.
 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 3. Standard: MFMA-4.
 4. Channels: Continuous slotted steel channel with inturred lips.
 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Vinyl.
9. Plastic Coating: PVC.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- C. High-Type, Single-Pipe Stand:
 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- D. High-Type, Multiple-Pipe Stand:
 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 2. Bases: One or more; plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.06 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.08 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.
- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. 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.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. 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 (DN 65) 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.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

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 a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. 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 (DN 15 to DN 750).
 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 13. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 14. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 15. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

16. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 17. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 18. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. 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 (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. 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.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe-riser resilient supports.
 - 2. Restraint channel bracings.
 - 3. Restraint cables.
 - 4. Seismic-restraint accessories.
 - 5. Mechanical anchor bolts.
- B. Related Requirements:
 - 1. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.02 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer.

- C. Welding certificates.
- D. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. The method of showing bracing and attachments to the structure for the identified distribution system are as detailed on the approved drawings with project specific notes and details. When bracing and attachments are based on a pre-approved installation guide (E.G. SMACNA or OSHPD OPM), copies of the installation guide or manual shall be available on the job site prior to the start of and during the hanging of the distribution systems. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 2.5.
 - c. Component Amplification Factor: 2.5.
 - 2. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - a. 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 are subjected.

2.02 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building

structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.03 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.01 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 of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. 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.
- B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.03 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - 3. Brace a change of direction longer than 12 feet (3.7 m).
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.

- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Drilled-in Anchors:
 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 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 Section 22 11 16 "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.
- 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.

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 (0.8-mm) 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 (64 by 19 mm).
 - 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.
 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, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Green.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 (A4) 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 (3.2 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 (38 mm)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 (19 mm) 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 (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - 1. Tag Material: Brass, 0.032-inch (0.8-mm) 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 (A4) 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: Approximately 4 by 7 inches (100 by 178 mm).
 - 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 09 91 23 "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, complying with ASME A13.1, 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 (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
 - 1. Low-Pressure, Compressed-Air Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.
 - 2. Domestic Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.

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 (38 mm), round.
 - b. Hot Water: 1-1/2 inches (38 mm), round.
 - c. Low-Pressure Compressed Air: 1-1/2 inches (38 mm), round.
 - 2. Valve-Tag Color:
 - a. Cold Water: Green.
 - b. Hot Water: Green.
 - c. Low-Pressure Compressed Air: Blue.
 - 3. Letter Color:
 - a. Cold Water: White.
 - b. Hot Water: White.
 - c. Low-Pressure Compressed Air: White.

3.05 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic hot-water piping.
 - 2. Domestic recirculating hot-water piping.
 - 3. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
 - 1. Section 22 07 16 "Plumbing Equipment Insulation."

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
 - 2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - 2. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - 3. Sheet Jacket Materials: 12 inches square.

4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.04 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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
 1. Piping Mockups:
 - a. One 10-foot section of NPS 2 straight pipe.
 - b. One each of a 90-degree threaded, welded, and flanged elbow.
 - c. One each of a threaded, welded, and flanged tee fitting.
 - d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
 - e. Four support hangers including hanger shield and insert.
 - f. One threaded strainer and one flanged strainer with removable portion of insulation.
 - g. One threaded reducer and one welded reducer.
 - h. One pressure temperature tap.
 - i. One mechanical coupling.
 2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Obtain Architect's approval of mockups before starting insulation application.

5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed.
- D. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

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 sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- H. 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 I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Manson Insulation Inc.; Alley Wrap.
- I. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Manson Insulation Inc.; Alley-K.
 - 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, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.05 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.06 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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

2.09 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGuire Manufacturing.
 - b. Plumberex.
 - c. Truebro; a brand of IPS Corporation.
 - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Truebro; a brand of IPS Corporation.
 - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Cleanouts.

3.04 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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.05 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. 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.
 7. 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.
 8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. 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.
3. 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.
4. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.07 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe 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.
- C. 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.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 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.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.02 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.03 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.03 ENCASUREMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet.

- C. Color: Natural.

2.04 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. Ford Meter Box Company, Inc. (The).

2.05 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Watts; a division of Watts Water Technologies, Inc.
 - c. Wilkins; a Zurn company.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 125 psig minimum at 180 deg F.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Precision Plumbing Products, Inc.
 - d. Victaulic Company.
 - 2. Standard: IAPMO PS 66.
 - 3. Electroplated steel nipple complying with ASTM F 1545.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.

5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."
- H. Install domestic water piping level without pitch and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. 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.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 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.
- F. Install supports for vertical copper tubing every 10 feet.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

- a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
- 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. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

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. Backflow preventers.
 - 2. Balancing valves.
 - 3. Strainers.
 - 4. Hose bibbs.
 - 5. Wall hydrants.
 - 6. Drain valves.
 - 7. Water hammer arresters.
 - 8. Trap-seal primer valves.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages For Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.03 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. 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. Woodford Manufacturing Company.
 - b. Zurn Plumbing Products Group; Wilkins Div.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. MIFAB, Inc.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. FEBCO; SPX Valves & Controls.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Body: Bronze for and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for and larger.
5. End Connections: Threaded.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Woodford Manufacturing Company.
2. Standard: ASSE 1052.
3. Operation: Up to back pressure.
4. Inlet Size: 3/4".
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least flow.

2.03 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

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 a product by one of the following:
 - a. Taco, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. NIBCO INC.
4. Type: Ball valve with two readout ports and memory setting indicator.
5. Body: Bronze,
6. Size: Same as connected piping, but not larger than.
7. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.04 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: minimum, unless otherwise indicated.
2. Body: Bronze for and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for and larger.
3. End Connections: Threaded and smaller; flanged for and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

2.05 HOSE BIBBS

A. Hose Bibbs HB-1

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc,
 - c. Zurn Plumbing Products Group; Light Commercial Operation
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Operation: Loose Key.
4. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
5. Box: Deep, flush mounting with cover.
6. Box and Cover Finish: Chrome plated.

7. Outlet: Exposed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7
 8. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 9. Operating Key(s): Two with each wall hydrant.
- B. Hose Bibbs HB-2:
1. Standard: ASME A112.18.1 for sediment faucets.
 2. Body Material: Bronze.
 3. Seat: Bronze, replaceable.
 4. Supply Connections: NPS 3/4 (DN 20) threaded or solder-joint inlet.
 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 6. Pressure Rating: 125 psig (860 kPa).
 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 9. Finish for Service Areas: Rough bronze.
 10. Finish for Finished Rooms: Chrome or nickel plated.
 11. Operation for Equipment Rooms: Wheel handle or operating key.
 12. Operation for Service Areas: Operating key.
 13. Operation for Finished Rooms: Operating key.
 14. Include operating key with each operating-key hose bibb.
 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.06 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 2. Pressure Rating: minimum CWP.
 3. Body: Copper alloy.
 4. Ball: Chrome-plated brass.
 5. Seats and Seals: Replaceable.
 6. Handle: Vinyl-covered steel.
 7. Inlet: Threaded or solder joint.
 8. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.07 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters WH-A:
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. PPP Inc.
 - c. MIFAB, 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.

2.08 TRAP-SEAL PRIMER VALVES

A. Supply-Type (Single), Trap-Seal Primer Valves TP-1:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- 2. Standard: ASSE 1018.
- 3. Pressure Rating: minimum.
- 4. Body: Bronze.
- 5. Inlet and Outlet Connections: threaded, union, or solder joint.
- 6. Gravity Drain Outlet Connection: threaded or solder joint.
- 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Supply-Type (Multiple), Trap-Seal Primer Valves TP-2:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- 2. Standard: ASSE 1018.
- 3. Pressure Rating: minimum.
- 4. Body: Bronze.
- 5. Inlet and Outlet Connections: threaded, union, or solder joint.
- 6. Gravity Drain Outlet Connection: threaded or solder joint.
- 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 23 Section "Basic Mechanical Materials and Methods" 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.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install Y-pattern strainers for water on supply side of each solenoid valve, and pump.
- E. Install water hammer arresters in water piping according to PDI-WH 201.
- F. 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.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- 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."

3.03 LABELING AND IDENTIFYING

- A. 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. Calibrated balancing valves.
 - 4. Supply-type, trap-seal primer valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 23 Section "Mechanical Identification."

3.04 FIELD QUALITY CONTROL

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

1. Test each reduced-pressure-principle backflow preventer 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.

3.05 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:
 - 1. Close-coupled, horizontally mounted, in-line centrifugal pumps.
- B. Related Sections include the following:
 - 1. Specification Section 01 91 13 "General Commissioning Requirements".

1.02 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.05 COORDINATION

- A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 CLOSE-COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS (CP-1 and CP-2)

A. Manufacturers:

1. GrundFos.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Armstrong Pumps Inc.

B. Description: Factory-assembled and -tested, overhung impeller, single-stage, close-coupled, horizontally mounted, in-line centrifugal pumps as defined in HI 1.1-1.2 and HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.

1. Pump Construction: All bronze.
 - a. Casing: Radially split, cast iron, with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
 - b. Impeller: ASTM B 584, statically and dynamically balanced, closed, and keyed to shaft.
 - c. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Bearings: Oil-lubricated; bronze-journal or ball type.
2. Shaft Coupling: Rigid type if pump is provided with coupling.
3. Motor: Single speed, with grease-lubricated ball bearings. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

C. Capacities and Characteristics:

1. Capacity: 3 gpm.
2. Total Dynamic Head: 20 feet.
3. Maximum Operating Pressure: 175 psig.
4. Maximum Continuous Operating Temperature: 225 deg F.
5. Inlet and Outlet Size: 3/4 inch.
6. Speed: 1750 rpm.
7. Motor Horsepower: 1/25.
8. Electrical Characteristics:
 - a. Volts: 115.
 - b. Phases: Single.
 - c. Hertz: 60.
 - d. Full-Load Amperes: 1.7.

2.03 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Manufacturers:
 - a. Honeywell International, Inc.
 - b. Square D.
 - c. White-Rodgers Div.; Emerson Electric Co.
 - 2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
 - 3. Range: 65 to 200 deg F.
 - 4. Operation of Pump: On or off.
 - 5. Transformer: Provide if required.
 - 6. Power Requirement: 120 V, ac.
 - 7. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

2.04 BUILDING-AUTOMATION-SYSTEM INTERFACE

- A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:
 - 1. On-off status of each pump.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install close-coupled, horizontally mounted, in-line centrifugal pumps with motor and pump shafts horizontal.
- E. Install continuous-thread hanger rods and elastomeric hangers of sufficient size to support pump weight. Fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

3.03 CONTROL INSTALLATION

- A. Install immersion-type thermostats in hot-water return piping.

3.04 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 pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Close-coupled, horizontally mounted, in-line centrifugal pumps.
 - 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
 - 3. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and gage connectors.
- D. Ground equipment according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- F. Connect thermostats to pumps that they control.
- G. Interlock pump with water heater burner and time delay relay.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set thermostats for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 7. Start motor.
 - 8. Open discharge valve slowly.
 - 9. Adjust temperature settings on thermostats.
 - 10. Adjust timer settings.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps. Refer to Division 01 Section "Closeout Procedures."

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, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.

1.02 DEFINITIONS

- A. PE: Polyethylene plastic.

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: 10-foot head of water.
- 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. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
- C. 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. 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 A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, 4 stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) Husky.
 - 2) Clamp-All Corp.
 - 3) Mission Rubber Co.

2.04 PVC PIPE AND FITTINGS

- A. 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 and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, condensate drain piping shall be any of the following:
 - 1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.

3.02 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 23 Section "Basic Materials and Methods."
- B. Install seismic restraints on piping.
- C. 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.
- D. Install underground PVC piping according to ASTM D 2321.
- E. 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.

- F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. 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 all piping.
 - 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.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- 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. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 HANGER AND SUPPORT INSTALLATION

- A. 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.
- 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, with 3/8-inch minimum rods.
- E. 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.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
- H. Install supports for vertical [ABS] [and] [PVC] piping every 48 inches (1200 mm).
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.06 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. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.07 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.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.08 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:
1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints (for Kitchen Grease Waste system).
- E. Aboveground, condensate drain piping shall be any of the following:
1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following plumbing specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Floor sinks.
 - 4. Drain Receptors.

1.02 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Piping: 125 psig.
 - 2. Sanitary Waste and Vent Piping: 10-foot head of water.

1.03 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
 - 1. Balancing valves, water filters, and strainers.
 - 2. Thermostatic water mixing valves and water tempering valves.
 - 3. Water hammer arresters, air vents, and trap seal primer valves and systems.
 - 4. Drain valves, hose bibbs, hydrants, and hose stations.
 - 5. Sleeve penetration systems.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field test reports.
- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
 - 1. Water filters.
 - 2. Thermostatic water mixing valves and water tempering valves.
 - 3. Trap seal primer valves and systems.

1.04 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

- 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: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
 - 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.05 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. Water Filter Cartridges: Equal to 200 percent of amount installed for each type and size indicated.
 - 2. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

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. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CLEANOUTS

- A. Cleanouts, WCO: Comply with ASME A112.36.2M or ASME A112.3.1.
 - 1. Application: Wall cleanout.
 - 2. Products:
 - a. Josam Co.
 - b. Smith, Jay R. Mfg. Co.
 - c. Zurn Industries, Inc., Specification Drainage Operation
 - 3. Body or Ferrule Material: Cast iron.
 - 4. Clamping Device: Required.
 - 5. Outlet Connection: Threaded.
 - 6. Closure: Brass plug with straight threads and gasket.
 - 7. Adjustable Housing Material: Cast iron with threads.

8. Frame and Cover Material and Finish: Polished bronze.
9. Frame and Cover Shape: Round.

2.03 FLOOR DRAINS

- A. Floor Drains, FD-1: Comply with ASME A112.21.1M.
 1. Application: Shower drain.
 2. Products:
 - a. Josam Co.; Model 30000-Z-A.
 - b. Smith, Jay R. Mfg. Co.; Fig. 2005-A.
 - c. Zurn Industries, Inc., Specification Drainage Operation; Model Z-415.
 3. Body Material: Gray iron.
 4. Seepage Flange: Required.
 5. Clamping Device: Required.
 6. Outlet: Bottom.
 7. Exposed Surfaces and Interior Lining: Not required.
 8. Sediment Bucket: Not required.
 9. Top or Strainer Material: Nickel bronze.
 10. Top of Body and Strainer Finish: Chrome.
 11. Top Shape: Round.
 12. Dimensions of Top or Strainer: 5-inches diameter.
 13. Top Loading Classification: Light Duty.
 14. Trap Material: Cast iron.
 15. Trap Pattern: Standard P-trap with trap primer connection.
 16. Trap Features: Not required.
 17. Provide min. 3-inch waste connection.

2.04 FLOOR SINKS

- A. Floor Sinks, FS-1: Comply with ASME A12.21.1M.
 1. Application: Floor Sink.
 2. Products:
 - a. Josam Co.
 - b. Smith, Jay R. Mfg. Co.; Fig 3100.
 - c. Zurn Industries, Inc., Specification Drainage Operation; Model No. Z-1910.
 3. Body Material: Gray iron.
 4. Seepage Flange: Required.
 5. Clamping Device: Required.
 6. Outlet: Bottom.
 7. Exposed Surfaces and Interior Lining: Acid-resistant enamel.

8. Sediment Bucket: Not required.
 9. Top Material: Gray iron.
 10. Top Shape: Square.
 11. Dimensions of Top or Strainer: 8-1/2 inch square.
 12. Top Loading Classification: Medium Duty.
 13. Trap Material: Cast iron.
 14. Trap Pattern: Standard P-trap.
 15. Trap Features: Trap seal primer valve drain connection.
 16. Provide min. 3-inch waste connection.
- B. Drain Receptor, DR-1: Comply with ASME A112.21.2M.
1. Applications: Drain receptor.
 2. Products:
 - a. Smith, Jay R. Mfg. Co.; Fig. 3970.
 - b. Or approved equal.
 3. Body Material: Cast iron.
 4. Dimensions of Body: 10 ½ inches diameter.
 5. Combination Flashing Ring and Gravel Stop: Required.
 6. Outlet: Bottom.
 7. Solid Water Dam.
 8. Extension Collars: Required.
 9. Underdeck Clamp: Required.
 10. Sump Receiver: Required.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- C. 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.
- D. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

- E. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- F. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- G. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- H. 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.
- I. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- J. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- K. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- M. 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 pipefittings.

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.
- C. Connect plumbing specialties to piping specified in other Division 22 Sections.
- D. Ground equipment.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.03 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve, and trap seal primer system.
 - 1. Text: 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.
 - 2. Refer to Division 23 Section "Identification for HVAC Piping and Equipment" for nameplates and signs.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain trap seal primer systems. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grease interceptors.
 - 2. Precast-concrete manhole risers.

1.02 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Piping connections. Include size, location, and elevation of each.
 - 2. Interface with underground structures and utility services.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste interceptors to include in emergency, operation, and maintenance manuals.

1.04 FIELD CONDITIONS

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of sewer services without Owner's written permission.

PART 2 - PRODUCTS

2.01 GREASE INTERCEPTORS

- A. Precast-Concrete Grease Interceptors: Comply with ASTM C913.
 - 1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
 - 2. Structural Design Loads:
 - a. Heavy-Traffic Load: Comply with ASTM C890, A-16.
 - 3. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into interceptor walls, for each pipe connection.
 - 4. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
 - 5. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter cover.

- a. Ductile Iron: ASTM A536, Grade 60-40-18, unless otherwise indicated.
 - b. Gray Iron: ASTM A48/A48M, Class 35, unless otherwise indicated.
 - c. Include indented top design with lettering cast into cover, using wording equivalent to "GREASE INTERCEPTOR."
6. Capacities and Characteristics:
- a. Length by Width by Depth: 102 inches by 69 inches by 72 inches.
 - b. Number of Compartments: Two.
 - c. Retention Capacity: 1200 gallon.
 - d. Inlet and Outlet Pipe Size: 4 NPS.
 - e. End Connections: Hub.
 - f. Cleanout: Integral or field installed on outlet.
 - g. Vent Pipe Size: 4 NPS.
 - h. Mounting: Below grade.

2.02 PRECAST-CONCRETE MANHOLE RISERS

- A. Precast Concrete Manhole Risers: ASTM C478 (ASTM C478M), with rubber-gasket joints.
 - 1. Structural Design Loads:
 - a. Light-Traffic Load: Comply with ASTM C890, A-8.
 - b. Medium-Traffic Load: Comply with ASTM C890, A-12.
 - c. Heavy-Traffic Load: Comply with ASTM C890, A-16.
 - d. Walkway Load: Comply with ASTM C890, A-03.
 - 2. Length: From top of underground concrete structure to grade.
 - 3. Riser Sections: 3-inch (75-mm) minimum thickness and 24-inch diameter.
 - 4. Top Section: Eccentric cone unless otherwise indicated. Include top of cone to match grade ring size.
 - 5. Gaskets: ASTM C443 (ASTM C443M), rubber.
- B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.
- C. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter cover.
 - 1. Ductile Iron: ASTM A536, Grade 60-40-18, unless otherwise indicated.
 - 2. Gray Iron: ASTM A48/A48M, Class 35, unless otherwise indicated.
 - 3. Include indented top design with lettering cast into cover, using wording equivalent to the following:
 - a. Grease Interceptors in Sanitary Sewerage System: "GREASE INTERCEPTOR."

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 INSTALLATION

- A. Install precast concrete interceptors according to ASTM C891.
- B. Set interceptors level and plumb.
- C. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
- D. Set tops of manhole frames and covers flush with finished surface in pavements.
 - 1. Set tops 3 inches (75 mm) above finish surface elsewhere unless otherwise indicated.
- E. Set tops of grating frames and grates flush with finished surface.
- F. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
 - 1. Above-Floor Installation: Set unit with bottom resting on floor unless otherwise indicated.
 - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 - 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

3.03 PIPING CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

3.04 IDENTIFICATION

- A. Identification materials and installation are specified in Section 312000 "Earth Moving."
 - 1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - 2. Use warning tapes or detectable warning tape over ferrous piping.
 - 3. Use detectable warning tape over nonferrous piping and over edges of underground structures.
- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Grease interceptors.

3.05 PROTECTION

- A. Protect sanitary waste interceptors from damage during construction period.

- B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION

SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.02 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water (30 kPa).
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.06 PROJECT CONDITIONS

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of storm-drainage service.

2. Do not proceed with interruption of storm-drainage service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 1. Standards: ASTM C 1277 and ASTM C 1540.
 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.03 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
 3. Shielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1460.
 - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Dielectric Fittings:

2.04 ENCASUREMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Material: High-density, crosslaminated PE film of 0.004-inch (0.10-mm) or LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black.

PART 3 - EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
 - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- M. 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.
- N. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 6. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
 6. Spacing for 10-foot (3-m) pipe lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.06 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

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.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

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 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
- C. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.

END OF SECTION

SECTION 22 14 23
STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Roof drains.
 - 2. Miscellaneous storm drainage piping specialties.
 - 3. Cleanouts.
 - 4. Through-penetration firestop assemblies.
 - 5. Flashing materials.

1.02 ACTION SUBMITTALS

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

1.03 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 METAL ROOF DRAINS

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains RD-1:
 - 1. Jay R Smith
 - 2. Zurn
 - 3. Mifab
 - 4. Standard: ASME A112.6.4, for general-purpose roof drains.
 - 5. Body Material: Cast iron.
 - 6. Dimension of Body: Nominal 14-inch (357-mm) diameter.
 - 7. Flow-Control Weirs: Not required.
 - 8. Outlet: Bottom.
 - 9. Underdeck Clamp: Required.
 - 10. Sump Receiver Plate: Required.
 - 11. Dome Material: Cast iron.
 - 12. Water Dam: Not required.
- B. Cast-Iron, Large-Sump, General-Purpose Overflow Roof Drains ORD-1:
 - 1. Jay R Smith
 - 2. Zurn
 - 3. Mifab

4. Standard: ASME A112.6.4, for general-purpose roof drains.
5. Body Material: Cast iron.
6. Dimension of Body: Nominal 14-inch (357-mm) diameter.
7. Flow-Control Weirs: Not required.
8. Outlet: Bottom.
9. Underdeck Clamp: Required.
10. Sump Receiver Plate: Required.
11. Dome Material: Cast iron.
12. Water Dam: 2 inches (51 mm) high.

2.02 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Conductor Nozzles DN-1

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.03 CLEANOUTS

A. Floor Cleanouts FCO:

1. Jay R Smith
2. Mifab
3. Josam
4. Zurn Industries.
5. Standard: ASME A112.36.2M, for threaded, adjustable housing cleanouts.
6. Size: Same as connected branch.
7. Type: Threaded, adjustable housing.
8. Body or Ferrule Material: Cast iron.
9. Clamping Device: Required.
10. Outlet Connection: Threaded.
11. Closure: Cast-iron plug.
12. Adjustable Housing Material: Cast iron with threads.
13. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
14. Frame and Cover Shape: Round.
15. Top-Loading Classification: Light Duty.
16. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Test Tees:

1. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
2. Size: Same as connected drainage piping.

3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
 4. Closure Plug: Countersunk or raised head, brass.
 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- C. Wall Cleanouts WCO:
1. Jay R Smith
 2. Mifab
 3. Josam
 4. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
 5. Size: Same as connected drainage piping.
 6. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
 7. Closure: Countersunk or raised-head, cast-iron plug.
 8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 9. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
 10. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.04 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
1. Standard: ASTM E 814, for through-penetration firestop assemblies.
 2. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.

2.05 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elmdor Stoneman 6lb lead flashing.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install expansion joints, if indicated, in roof drain outlets.
 - 3. Position roof drains for easy access and maintenance.
- B. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 - 1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 - 3. Locate cleanouts at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install test tees in vertical conductors and near floor.
- G. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- H. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- I. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
 - D. Secure flashing into sleeve and specialty clamping ring or device.
 - E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 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

SECTION 22 33 00
ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, domestic-water booster heaters.
 - 2. Flow-control, electric, tankless, domestic-water heaters.
 - 3. Thermostat-control, electric, tankless, domestic-water heaters.
 - 4. Domestic-water heater accessories.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.05 COORDINATION

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

1.06 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.

- a. Electric, Tankless, Domestic-Water Heaters: One year(s).

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.0.
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.02 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

2.03 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

- A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chromomite Laboratories, Inc; a division of Morris Group International.
 - b. Eemax, Inc.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.
 - 4. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
 - 5. Support: Bracket for wall mounting.
 - 6. Capacity and Characteristics:
 - a. Flow Rate: 1 gpm.
 - b. Maximum Temperature Setting: 105.
 - c. Power Demand: 6240 kilowatts.
 - d. Electrical Characteristics:

- 1) Volts: 208 V.
- 2) Phases: Single.
- 3) Hertz: 60 Hz.

2.04 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches (457 mm) above floor on wall bracket.
 1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
- C. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.02 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

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

3.04 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain tankless, electric, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION

SECTION 22 34 00
FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.02 PERFORMANCE REQUIREMENTS

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

1.03 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, 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.
- B. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

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

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year(s).

PART 2 - PRODUCTS

2.01 COMMERCIAL, GAS-Fired, STORAGE, domestic-WATER HEATERS

- A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters WH-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lochinvar Corporation.

- b. Rheem Manufacturing Company.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
2. Standard: ANSI Z21.10.3/CSA 4.3.
 3. Description: Manufacturer's proprietary design to provide at least 96 percent combustion efficiency at optimum operating conditions.
 4. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 (DN 65) 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.
 5. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required 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 or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
 - g. Temperature Control: Adjustable thermostat.
 - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 6. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- B. Capacity and Characteristics:
1. Capacity: 100 gal.
 2. Recovery: 223 gph at 80 deg F temperature rise.
 3. Temperature Setting: 140 deg F.

4. Fuel Gas Demand: 150 cfh.
5. Fuel Gas Input: 150,000 Btu/h.
6. Electrical Characteristics:
 - a. Volts: 120.
 - b. Phase: Single.
 - c. Hertz: 60.
7. Minimum Vent Diameter: 4 inches.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks WH-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. Flexcon Industries.
 - c. Taco, Inc.
2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig (1035 kPa).
 - b. Capacity Acceptable: 11 gal. minimum.
 - c. Air Precharge Pressure: 80.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig (3.5-kPa) pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

- H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- I. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- J. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.
- L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."
- D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. 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.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."
- G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23 "Ball Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements.
- C. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION

SECTION 22 41 00
COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Faucets.
 - 2. Bar sinks.
 - 3. Supply fittings.
 - 4. Waste fittings.
- B. Related Requirements:
 - 1. Section 22 42 13.13 "Commercial Water Closets."
 - 2. Section 22 42 16.13 "Commercial Lavatories."
 - 3. Section 22 42 16.16 "Commercial Sinks."

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.
- B. Sample Warranty: For special warranty.

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 - 3. Toilet Seats: Equal to 5 percent of amount of each type installed.

1.05 PLUMBING FIXTURES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.
- B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.

- C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.
- D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7
- F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.01 BAR SINKS

- A. Bar Sinks S-1: Single bowl, counter mounted, stainless steel.
 - 1. Stainless-Steel Bar Sinks:
 - a. Just Sinks
 - b. Elkay
 - c. Or approved equal.
 - 2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel lavatories.
 - b. Type: Self-rimming.
 - c. Overall Dimensions: 21-inches by 19-inches.
 - d. Bowl Dimensions: 16-inches by 14-inches.
 - 3. Faucet: S-1.
 - 4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
 - 5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.02 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Sink Faucets S-1 and S-2: Solid brass, bar sink.
 - 1. General-Duty, Solid-Brass Faucets:
 - a. Just Sinks
 - b. Elkay
 - c. Chicago Faucets
 - 2. Standard: ASME A112.18.1/CSA B125.1.

3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 2.0 gpm unless otherwise indicated.
7. Mixing Valve: Two-lever handle.
8. Backflow-Prevention Device for Hand Spray: Not required.
9. Centers: 8 inches (203 mm) Adjustable.
10. Mounting: Deck, exposed.
11. Handle(s): Wrist blade, 4 inches (102 mm).
12. Spout Type: Swivel gooseneck.
13. Spout Outlet: Aerator.
14. Drain: Grid.

2.03 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout outlet materials that will be in contact with potable water.
- B. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.04 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Bar Sink and Kitchen Sink Supply Fittings:
 1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
 2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.
 - a. Operation: Loose key.
 3. Risers:
 - a. Size: NPS 1/2 (DN 15) for bar sinks and kitchen sinks.
 - b. Material: Chrome-plated, soft-copper flexible tube riser.

2.05 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 (DN 40) straight tailpiece for standard bar sinks and kitchen sinks.
- C. Trap:
 1. Size: NPS 1-1/2 (DN 40) for bar sinks and kitchen sinks.

2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated-brass or -steel wall flange.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install counter-mounting fixtures in and attached to casework.
- C. 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.
 1. Exception: Use ball or gate valves if supply stops are not specified with fixture.
- D. 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.
- E. Install traps on fixture outlets.
 1. Exception: Omit trap on fixtures with integral traps.
 2. Exception: Omit trap on indirect wastes unless otherwise indicated.
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."
- G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- H. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.04 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 13.13
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Flushometer valves.
 - 3. Toilet seats.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

1.05 PLUMBING FIXTURES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.
- B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.
- D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7

- F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.01 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

- A. Water Closets WC-1: Floor mounted, bottom outlet, top spud.
 - 1. American Standard.
 - 2. Kohler
 - 3. Toto
 - 4. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Accessible.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
 - 5. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
 - 6. Flushometer Valve: WC-1.
 - 7. Toilet Seat: WC-1.
- B. Water Closets WC-2: Floor mounted, bottom outlet, top spud (Accessible).
 - 1. American Standard.
 - 2. Kohler
 - 3. Toto
 - 4. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Accessible.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
 - 5. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
 - 6. Flushometer Valve: WC-1.

7. Toilet Seat: WC-1.

2.02 FLUSHOMETER VALVES

- A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves WC-1, WC-2:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company.
 - b. TOTO USA, INC.
 - c. Zurn Industries, LLC.
 2. Standard: ASSE 1037.
 3. Minimum Pressure Rating: 125 psig (860 kPa).
 4. Features: Include integral check stop and backflow-prevention device.
 5. Material: Brass body with corrosion-resistant components.
 6. Exposed Flushometer-Valve Finish: Chrome plated.
 7. Panel Finish: Chrome plated or stainless steel.
 8. Style: [Exposed] [Concealed].
 9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 11. Consumption: 1.28 gal. (4.8 L) per flush.
 12. Minimum Inlet: NPS 1 (DN 25).
 13. Minimum Outlet: NPS 1-1/4 (DN 32).

2.03 TOILET SEATS

- A. Toilet Seats WC-1, WC-2:
 1. Olsonite.
 2. Church.
 3. Bemis.
 4. Standard: IAPMO/ANSI Z124.5.
 5. Material: Plastic.
 6. Type: Commercial (Heavy duty).
 7. Shape: Elongated rim, open front.
 8. Hinge: Self-sustaining, check.
 9. Hinge Material: Noncorroding metal.
 10. Seat Cover: Not required.
 11. Color: White.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Water-Closet Installation:
 - 1. Install level and plumb according to roughing-in drawings.
- B. Flushometer-Valve Installation:
 - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 - 4. Install actuators in locations that are easy for people with disabilities to reach.
- C. Flushometer-Valve Installation:
 - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install actuators in locations that are easy for people with disabilities to reach.
 - 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Install toilet seats on water closets.
- E. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 - 3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- F. Joint Sealing:
 - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to water-closet color.
 - 3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 13.16
COMMERCIAL URINALS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Urinals.
 - 2. Flushometer valves.
 - 3. Supports.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

1.05 DSA NOTES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213-3.
- B. Effective March 1, 2017, all single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3. 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 CBC Section 11B-703. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM", or "UNISEX RESTROOM". DSA BU 17-01.
- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. 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.
- E. Heights and location of all fixtures shall be according to 2016 CBC Sections 11B-602 through 11B-612.

- F. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for childrens water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- G. Accessible lavatories and sinks shall be mounted with the front of the nhigher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7.
- H. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.5.

PART 2 - PRODUCTS

2.01 WALL-HUNG URINALS

- A. Urinals UR-1: Wall hung, back outlet, washout.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Washout with extended shields.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Low.
 - f. Spud Size and Location: NPS 3/4 (DN 20), top.
 - g. Outlet Size and Location: NPS 2 (DN 50), back.
 - h. Color: White.
 - 3. Flushometer Valve: UR-1.
 - 4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2 (DN 50).
 - 5. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
 - 6. Urinal Mounting Height: Standard.
- B. Urinals UR-2: Wall hung, back outlet, washout, accessible.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.

- b. Kohler Co.
- 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Washout with extended shields.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Low.
 - f. Spud Size and Location: NPS 3/4 (DN 20), top.
 - g. Outlet Size and Location: NPS 2 (DN 50), back.
 - h. Color: White.
- 3. Flushometer Valve: UR-1.
- 4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2 (DN 50).
- 5. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
- 6. Urinal Mounting Height: Handicapped/elderly according to ICC A117.1.

2.02 URINAL FLUSHOMETER VALVES

- A. Lever-Handle, Diaphragm Flushometer Valves UR-1 and UR-2:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Zurn Industries, LLC.
 - 2. Standard: ASSE 1037.
 - 3. Minimum Pressure Rating: 125 psig (860 kPa).
 - 4. Features: Include integral check stop and backflow-prevention device.
 - 5. Material: Brass body with corrosion-resistant components.
 - 6. Exposed Flushometer-Valve Finish: Chrome plated.
 - 7. Panel Finish: Chrome plated or stainless steel.
 - 8. Style: Exposed.
 - 9. Consumption: 0.125 gal. per flush.
 - 10. Minimum Inlet: NPS 3/4 (DN 20).
 - 11. Minimum Outlet: NPS 3/4 (DN 20).

2.03 SUPPORTS

- A. Type I Urinal Carrier:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.

- b. Josam Company.
 - c. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Urinal Installation:
 - 1. Install urinals level and plumb according to roughing-in drawings.
 - 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
 - 3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
 - 1. Install supports, affixed to building substrate, for wall-hung urinals.
 - 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
 - 3. Use carriers without waste fitting for urinals with tubular waste piping.
 - 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
- C. Flushometer-Valve Installation:
 - 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
- D. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 - 3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
 - 1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to urinal color.
 - 3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.04 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.13
COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Lavatories.
 - 2. Faucets.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

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.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.06 PLUMBING FIXTURES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.
- B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.

- D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children’s water closets, 11B-605.4 for urinals, 11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34” maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7
- F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.01 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Accessible plumbing fixtures shall comply with all of the requirements of 2013 CBC Division 6.
- B. Heights and location of all fixtures shall be according to 2013 CBC Sections 11B-602 through 11B-612 and DSA Check List Fig. 15-A.
- C. Fixture controls shall comply with 2013 CBC Sections 11B-601.3 for drinking fountains, 11B-604.6 for water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-604.9.5 for children's water closets, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- D. Each accessible sink shall be a maximum of 6-1/2” deep. Sinks shall be mounted with the counter or rim no higher than 34” above the finish floor. 2013 CBC Section 11B-213.3.
- E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.
- F. Lavatory L-1: Ledge back, vitreous china, wall mounted.
 - 1. American Standard
 - 2. Kohler
 - 3. Or approved equal.
 - 4. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Nominal Size:Rectangle, 20 inches by 18 inches..
 - d. Faucet-Hole Punching: Three holes, 2-inch (51-mm) centers.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting Material: Chair carrier.
 - 5. Faucet: L-1.
 - 6. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier.

2.02 AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Lavatory Faucets - Automatic Type: Battery Powered Electronic Sensor Operated, Mixing, L-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets; Geberit Company.
 - b. Sloan Valve Company.
 - c. Zurn Industries, LLC.
 - 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 - 3. 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.
 - 4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 5. Body Type: Single hole.
 - 6. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
 - 7. Finish: Polished chrome plate.
 - 8. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
 - 9. Mounting Type: Deck, concealed.
 - 10. Spout: Rigid type.
 - 11. Spout Outlet: Aerator.
 - 12. Drain: Grid.

2.03 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 1/2 (DN 15).

2. Chrome-plated, soft-copper flexible tube riser.

2.04 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 1. NPS 1/2 (DN 15).
 2. Chrome-plated, soft-copper flexible tube riser.

2.05 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.
- C. Trap:
 1. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32).
 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated, brass or steel wall flange.
- D. Lavatory Carrier:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. WATTS.
 2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.

- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.04 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.05 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.06 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

- B. Adjust water pressure at faucets to produce proper flow.
- C. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.07 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.16
COMMERCIAL SINKS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Service sinks.
 - 2. Sink faucets.
 - 3. Supply fittings.
 - 4. Waste fittings.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sinks to include in 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.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.06 PLUMBING FIXTURES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.
- B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.
- D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals,

11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

- E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7
- F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.01 SERVICE SINKS

- A. Service Sinks MS-1: Enameled, cast iron, trap standard mounted.
 - 1. American Standard
 - 2. Kohler
 - 3. Or Approved Equal.
 - 4. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Style: With front apron and raised back.
 - c. Nominal Size: 28 by 28 inches (710 by 710 mm).
 - d. Color: White.
 - e. Drain: Grid with NPS 3 (DN 80) outlet.
 - f. Rim Guard: Coated wire.
 - 5. Faucet: MS-1.

2.02 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets MS-1: Manual type, two-lever-handle mixing valve.
 - 1. Commercial, Solid-Brass Faucets.
 - a. Chicago Faucets
 - b. Speakman
 - c. Or Approved Equal.
 - 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 - 4. Body Type: Widespread.
 - 5. Body Material: Commercial, solid brass.
 - 6. Finish: Polished chrome plate.

7. Maximum Flow Rate: 2.2 gpm (8.3 L/min.).
8. Handle(s): Wrist blade, 4 inches (102 mm).
9. Mounting Type: Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Hose thread according to ASME B1.20.7.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Set floor-mounted sinks in leveling bed of cement grout.
- D. Install water-supply piping with stop on each supply to each sink faucet.
 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
 2. Install stops in locations where they can be easily reached for operation.
- E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- F. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 47 13
DRINKING FOUNTAINS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes drinking fountains and related components.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of drinking fountain.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include operating characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 DRINKING FOUNTAINS DF-1: Stainless Steel, wall mounted.

- 1. Stainless-Steel Drinking Fountains:
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Elkay Manufacturing Co. Model VRCTLDDWS
 - 2) Haws Corporation.
 - 3) Or equal.
- 2. Standards:
 - a. Comply with 2010 ADA Standard and 2019 CBC.
 - b. Comply with NSF 61.
- 3. Type Receptor: Slab.
- 4. Receptor Shape: Rectangular.
- 5. Back Panel: Stainless-steel wall plate behind drinking fountain.
- 6. Bubblers: Two, with adjustable stream regulator, located on deck.
- 7. Control: Push button.
- 8. Drain: Grid type with NPS 1-1/4 (DN 32) tailpiece.
- 9. Supply: NPS 3/8 (DN 10) with shutoff valve.
- 10. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) chrome-plated brass P-trap and waste.
- 11. Support: ASME A112.6.1M, Type III lavatory carrier.
- 12. Bottle filler.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

3.05 CLEANING

- A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 00 10
MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work includes, but is not limited to, the following:
 - 1. Labor, material, equipment and transportation to complete the Work as shown on the drawings, specified herein and/or implied thereby.
 - 2. A requirement of the plumbing sections shall be to provide make-up water and drain final connections to systems and equipment.
 - 3. It is the intent of the project that the installation be coordinated to provide a complete and usable facility.
- B. Work not included in this division:
 - 1. Painting, except as hereinafter specified. See Division 9 for painting.
 - 2. Electrical, except for controls hereinafter specified. See Division 26 for electrical.
- C. Related Sections include the following:
 - 1. Division 1 Section 01 91 13 "General Commissioning Requirements."
 - 2. Division 23 Section 23 08 00 "Commissioning of HVAC."
 - 3. Division 23 Section 230050 "Basic Mechanical Materials and Methods."

1.02 DEFINITIONS

- A. Unless otherwise specified, "all clarification from," "field direction by," "submittals to," "approved by," "processed by," "permission from," and like mentioned herein shall mean from/by/to Architect.
- B. "Provide" means furnish and install referenced item with all appurtenances.
- C. "Shall" indicates a mandatory requirement.
- D. "Air conditioning" is defined as the treatment and/or handling of any air to any degree by the systems shown on the drawings and herein specified and is not restricted to refrigerated cooling.

1.03 DELIVERY AND STORAGE OF MATERIALS

- A. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage from any cause whatever, and provide adequate and proper storage facilities during the progress of the work. Replace all damaged and defective work, material or equipment prior to filing application for final acceptance. Properly protect all openings to equipment, piping, ductwork, accessories, etc. from dirt, dust, and debris prior to and during installation of the work. Ductwork stored at the jobsite shall be covered to protect from dirt, dust, debris, fire proofing, etc.

1.04 CODES AND STANDARDS

- A. Work and materials shall be in full accordance with the latest rules and regulations of the Local Fire Marshal; Codes listed in Section 01 41 00 – Regulatory Requirements; requirements of Division 01 – General Requirements; SMACNA “Guidelines for Seismic Restraints of Mechanical Systems”; and other applicable codes, laws or regulations of bodies lawfully empowered and having jurisdiction over this project. Nothing in the plans or specifications shall be construed to permit work not conforming to these codes. When codes conflict with one another, provide larger, higher or more restrictive standards without additional costs.

1.05 PERMITS

- A. Obtain all permits, patent rights, and licenses that are required for the performing of this work by all laws, ordinances, rules and regulations, or orders of any officer and/or body. Provide all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdictional authorities and observation by the Architect or the owner’s designated representatives.

1.06 EXPLANATION AND PRECEDENCE OF DRAWINGS

- A. Drawings and specifications are intended to be read together so that any work mentioned in one and not the other shall be executed the same as if mentioned in both.
- B. For purposes of clearness and legibility, drawings are essentially diagrammatic. The size and location of equipment is drawn to scale wherever possible. Contractor shall make use of data in the contract documents and shall verify this information at the building site.
- C. Where the contract specifications and/or drawings are in conflict, obtain clarification of such during bidding. Where addenda for clarification of such is not timely, base the bid on the higher standards or more restrictive requirements; prior to fabrication, obtain written clarification.
- D. The drawings indicate required size and points of termination of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. It is not intended that drawings indicate necessary offsets. The Contractor shall make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or costs to the Owner.
- E. It is intended that apparatus be located symmetrical with architectural elements. Refer to architectural details in completing the correlating work.
- F. The Contractor shall study drawings and specifications including, and not limited to, architectural, structural, mechanical, plumbing, fire protection, and electrical to determine conflict with ordinances and statutes. Errors or omissions shall be reported in writing, and changes shall be included in the as-built drawings and the additional work performed at no cost to the Owner.
- G. Submittal of bid shall indicate the Contractor has examined the site and drawings and has included required allowances in his bid. No allowance shall be made for any error resulting from Contractor's failure to visit job site and to review drawings and specifications. Bid shall include costs for required drawings and changes as outline above, all at no cost to owner.

1.07 RECORD DRAWINGS

- A. In addition for requirements for shop drawings specified elsewhere, provide and maintain on the job one complete set of blue line prints of the record drawings for all the mechanical and plumbing work. Carefully record on this set of prints, work including piping, valves, etc., which is installed differently from that indicated in the specifications and on the drawings; locate dimensionally from fixed points. The depth shall be indicated for all plugged wyes, tees and capped lines.
- B. These record drawings shall be continuously kept up-to-date, and shall be available for inspection at all times. Existing lines discovered shall be indicated on these drawings.
- C. At completion of work, provide a neat and legible reproducible set of these up-to-date record drawings which shall be individually signed and dated by the Contractor and the job inspector as to their accuracy.
- D. Record drawings shall be submitted for acceptance and approval to the Architect and Mechanical Engineer before final certificate of acceptance will be issued.
- E. Record drawings shall show the exact location of all control sensor devices.

1.08 CUTTING AND PATCHING

- A. Perform all cutting and fitting required for work of this section in rough construction of the building. Obtain permission of the Structural Engineer prior to cutting any structural building elements.
- B. All patching of finished construction of building shall be performed under the sections of specifications covering these materials by the trades at no additional cost to the Owner.
- C. All cutting of concrete work by Contractor shall be by core drilling or concrete saw. No cutting or coring shall be done without first obtaining the permission of the Architect and Owner.
- D. All patching of existing surfaces shall match existing material and finish.

1.09 DAMAGE BY LEAKS

- A. Contractor shall be responsible for damage to the grounds, walks, roads, buildings, finishes, surfaces, materials, equipment, piping systems, electrical systems and their equipment and contents, caused by leaks in the piping systems being installed or having been installed herein. He shall repair at his expense all damage so caused. All repair work shall be done as directed by the Architect and Owner.

1.10 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibilities.

1.11 LOCATIONS

- A. Coordinate in advance of the work, requirements for openings, equipment maintenance clearances, recesses and chases in the walls, partitions, equipment housekeeping pads, framing or openings. Should furnishing this information be neglected, delayed or incorrect and additional cutting is found to be required, the cost of same shall be borne by the Contractor. Nothing in this paragraph shall be construed to relieve the Contractor of the

responsibility for providing and paying for the required core drilling and openings in existing work.

B. Diagrammatic Indications on Drawings are:

1. Approximate only.
2. At various locations shown distorted for clarity.

C. Exact Locations Shall:

1. Be as required for proper installation in available space.
2. Avoid interference with architectural, electrical and structural features.
3. Be coordinated with the work of other trades toward the general purpose of having the work progress rapidly and smoothly with a minimum interference between one trade and another.
4. Preserve headroom and keep openings and passageways clear.
5. Have a neat arrangement symmetrical to the building lines, light and tile pattern.
6. Be reasonably accessible for hung ceiling areas for maintenance from the floor below. Equipment, valves, and other items requiring maintenance, adjustment and/or observation shall be accessible.

1.12 SUPPORTS, EQUIPMENT PADS, STAGING, ETC.

- A. Construction supports required for the proper installation of equipment shall be in accordance with the drawings, manufacturer's requirements, seismic requirements, and applicable codes. Check architectural and structural drawings for equipment pads by others. Provide staging, scaffolds, platforms, ladders or similar facilities required to properly install the work.

1.13 INTERRUPTION OF UTILITIES

- A. The Contractor shall schedule and coordinate all interruptions of utilities with the Architect and Owner within 30 days after award of contract. The Contractor shall submit to the Owner a schedule of proposed interruptions. At least 72 hours prior to the interruption, the contractor shall submit a request indicating the proposed date and duration of interruption, the work to be accomplished, the areas which will be affected and a proposed contingency plan to be followed in the event that normal service or facilities cannot be restored on schedule. Do not commence work until the time, date, and contingency have been approved in writing by the Architect and Owner.
- B. Provide any labor and materials necessary to restore services on a contingency basis should normal service or facilities not be restored on schedule.
- C. Preparatory work associated with each interruption shall be performed during normal work hours. The actual interruption required for tie-in shall be performed between 8 P.M. and 5 A.M. Maximum shutdown during this period of any system shall be 4 hours.

1.14 SUBSTITUTIONS

- A. If substitutions of controls or equipment requires any changes in the architectural, structural, mechanical, plumbing or electrical work from that shown on the drawings(including all environmental characteristics), the extra cost of the equipment or architectural, structural, mechanical, plumbing or electrical work shall be responsibility of the Contractor requesting the

substitution. All substitutions shall be approved by the Architect before purchase by the contractor.

- B. If the Contractor proposes substitutions of any equipment specified herein or on the drawings, it shall be the Contractor's responsibility to obtain approval from the Architect for such equipment as well as approval for anchorage of such equipment from the Architect, Structural Engineer, and governing approval agencies (Department of the State Architects - DSA),. All costs required for such approval shall be the responsibility of the Contractor requesting the substitution.

1.15 PREPARATION OF SUBMITTALS

- A. Refer to Division 1. In addition to the requirements of Division 1, provide the requirements specified herein.
- B. Prior to commencement of work and in accordance with the General Requirements, submit for review six copies of proposed equipment and material submittals. The Contractor shall verify the delivery dates are compatible with the specified construction schedule; and verify the equipment is sized to accommodate the conditions specified. Submittals shall include manufacturer's names and model numbers and shall comply with specifications and drawings. The Contractor shall bear the cost of changes necessary to accommodate substitutions if substitution is approved.
- C. Provide formal submittal to Architect. Review of the formal submittal is only for general conformance with design concept of project and general compliance with the information given in the contract documents. The Contractor is responsible for confirmation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all trades. Deviations from Drawings and Specifications shall be clearly and completely indicated (by a separate letter) in the formal submittals. Reviewed Submittals shall not relieve the Contractor of responsibility for errors or deviations.
 - 1. Where specific model numbers and/or manufacturers are specified or shown, it is the intent of the contract documents to procure the specified item(s). Alternate equipment may not be used unless data is submitted for consideration as a substitution in accordance with General Requirements and this section.
 - 2. Model numbers used may not indicate all features or options required for this specific installation. Modify the specified models to comply with the requirements, as specified or shown.
 - 3. Product Data for Proposed Substitutions:
 - a. Submit copies of complete data, with drawings and samples as appropriate, including:
 - 1) Comparison of the qualities of the proposed substitution with that specified.
 - 2) Changes required in other elements of the work because of the substitution.
 - 3) Affect on construction schedule.
 - 4) Cost data comparing the proposed substitution with the product specified.
 - 5) Availability of maintenance service and source of replacement materials.

- 6) Reference to three (3) projects similar to this where such equipment is installed and operating to two (2) or more years.
 - b. Acceptance of substitutions is entirely at the discretion of the Architect.
- D. Formal submittals shall be complete with catalog data and information properly marked to indicate equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities or performance as specified or indicated. Arrange the submittals in the same sequence as these Specifications and indicate the Section and Paragraph number (in the upper right-hand side with tabs) for which each submittal is intended. Incomplete submittals shall be rejected.
- E. Do not fabricate order or deliver materials or equipment until formal submittals have been approved. Where material or equipment is used without such permission, it is deemed that the material or equipment shall be in complete compliance with drawings and specifications, without additional cost where such compliance is lacking and may be required to be altered in the field.
- F. Submittals shall be bound and shall include, at a minimum, the following:
 1. Complete bill of materials listing equipment furnished.
 2. Catalog cut sheets of every component being provided (highlighted).
 3. Provide completed blue-line shop drawings of the packaged equipment detailing all field connection points.
 4. Dimensions, clearance requirements, weights, and capacities.
 5. Wiring diagrams showing control interface as applicable.
 6. Warranty sheets.
 7. Pressure drops as applicable.
- G. Contractor shall incur all costs for time spent by Engineer for review of more than two submittals on each item. Costs shall be based on Engineer's hourly billing rate schedule at the time of review. Rate schedule available upon request. Engineer shall invoice the contractor upon completion of review and shall be paid by the contractor within 30 days of date of invoice. Failure to remit will withdraw approval (if any) of submittals in question.

1.16 SHOP DRAWINGS:

- A. Proceed with preparation of shop drawings immediately upon receiving an authorization to proceed for the project. Shop drawings shall be originally prepared by the contractor. Provide minimum 1/4" scale shop drawings in electronic format. Submit a complete set in one package prior to material fabrication, order and installation.
- B. Include:
 1. Duct and pipe elevations and sizes.
 2. Double line ductwork and piping (4" and larger).
 3. Actual size of purchased equipment from certified shop drawings.
 4. Access panels including ceiling panels.
 5. Access clearances for equipment.
 6. Actual locations of ceiling diffusers/ supply registers and return registers.
 7. Actual locations of manual volume dampers.

8. Locations of structural penetrations such as beams.
 9. Actual location of control panels and power connections to equipment.
 10. Color coded duct and piping based on material used.
 11. Label and tag schedule for equipment.
 12. Duct transitions to clear beams or tight areas.
 13. Room temperature sensor locations.
 14. Point of connection to utilities outside the building.
 15. Sections or 3-dimensional drawings of congested areas.
 16. Gridlines.
 17. Duct and piping supports on roof.
- C. Coordinate with other trades in preparation of shop drawings.
 - D. Submit a copy of coordinated shop drawings to General Contractor for distribution to other trades, including electrical and fire sprinkler contractor.
 - E. Submit to commissioning agent for approval to assure design intent is met.
 - F. Prior to fabrication and upon receiving approval from commissioning agent, submit a complete set of shop drawings at one time to the mechanical engineer.

1.17 ELECTRICAL REQUIREMENTS

- A. Coordinate the following items with Division 26:
 1. Power wiring
 2. Power Supply Voltage Requirements
 3. Safety switches
 4. Combination controllers
 5. Disconnect switches
 6. Motor starters
 7. Circuit breakers
 8. Motor-control equipment forming part of motor control centers or switchgear assemblies
 9. Electrical connections of the mechanical equipment to the electrical power source shall be coordinated with and provided under Division 26.

1.18 MOTORS

- A. Before order is placed for electrical devices, the Contractor shall check with the Electrical contractor and verify requirements as to type, mounting and current characteristics as well as to any special delivery instructions. Motors provided under Division 23 shall be minimum of 10% normal rating above brake horsepower (BHP) rating of equipment driven.

1.19 TESTS

- A. Contractor shall make tests required by legally constituted authorities and as listed below.

1. Tests shall be made in the presence of the Owner or his representative and a duly authorized inspector. The Owner or his representative shall be notified 5 days before tests are made.
2. Concealed work and insulated work shall remain uncovered until required testing has been performed and approved by the Owner. If work to be tested is covered before the approval of the Owner or his authorized representative has been obtained, it shall be uncovered for testing at the Contractor's expense.
3. Obtain required documents of certification indicating approval, acceptance and compliance with the requirements of all administrative authorities having jurisdiction over the work. No final payment shall be made until all such certificates are delivered to the Owner.
4. Furnish labor, materials, instruments and bear other costs in connection with all tests.
5. Piping systems, except as hereinafter noted, shall be given hydrostatic (with water) test of a least 150% of the maximum operating pressure but no less than 150 psig.
6. Before making test, remove or valve off from the system, gauges, traps, and other apparatus or equipment which may be damaged by test pressure.
7. Install a calibrated test pressure gauge in the system to observe any loss in pressure. Maintain the required test pressure for a sufficient length of time to enable an inspection to be made of all joints and connections. Perform tests after installation and prior to acceptance.
8. Final pressures at the end of the test period shall be no more or less than that caused by expansion or contraction of the test medium due to temperature changes.
9. After tests have been made and leaks repaired, clean and flush systems as hereinafter specified. Water piping shall be left under supply main pressure for the balance of the construction period.
10. Tests for mechanical, plumbing, and fire protection systems are specified within their own section. Equipment and ductwork system tests are specified in the test and balance section.
11. Provide necessary provisions and tests for maintaining the operational condition and cleanliness of existing systems.

1.20 LABOR AND MATERIALS

- A. Labor shall be carefully skilled for this kind of work, and under the direction of a competent foreman.
- B. Materials shall be new, in perfect condition and of domestic manufacturer. Materials for similar uses to be of same type and manufacturer.
- C. Equipment shall bear the manufacturer's label showing performance characteristics. Identifying size number shall be given only when it is not practicable or customary to show performance characteristics.
- D. Valves, pipe, fittings, etc., shall bear the manufacturer's name or trademark.
- E. Unless otherwise specified herein, equipment and fixtures shall be installed in accordance with the manufacturer's recommendations, including recommended service and removal clearances.

1.21 PROTECTION AND CLEAN-UP

- A. Protection: Provide for the safety and good condition of materials and equipment until final acceptance of the Architect. Protect materials and equipment from dirt, dust, debris, and damage from any cause whatever, and provide adequate and proper storage facilities during the progress of the work and replace all damaged and defective material, equipment or work precedent to filing application for final acceptance.
- B. Cleaning:
 - 1. Unless a more stringent requirement is specified, thoroughly clean all parts of the piping, ductwork, fixtures, apparatus and equipment. All parts shall be thoroughly cleaned of dirt, dust, debris, cement, plaster and other materials, and all grease and oil spots removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Clean all systems, including piping and ductwork prior to test.
 - 2. Exposed rough metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left in clean condition to receive painter's finish. Where factory prime coat has been damaged, this Contractor shall be responsible for restoration of same.

1.22 ACCESS PANELS

- A. Access Doors and Panels:
 - 1. Wherever volume dampers, fire dampers, smoke fire dampers, controls, valves or other items or parts of the installation which require periodic inspection or adjustments are concealed by permanent non-removable construction, an access door shall be provided. Rating of access panel shall be determined by rating of wall or ceiling in which panel is installed. Types to be as approved and as appropriate for the surface and construction in which it is installed. Verify all locations with Architect and other trades.
 - 2. Access doors and panels shall be of sufficient size and shall be located properly to assure service to the intended item.

1.23 MAINTENANCE, OPERATION INSTRUCTION

- A. General: Thoroughly instruct the Owner's operators in every detail of operation of the system. Provide the Owner with a list of all equipment, giving the manufacturer's name, model number, serial number, parts list and complete internal wiring diagrams. All directions for operation furnished by the manufacturer shall be carefully saved and turned over to the Owner, together with written sequence of operation, operating and maintenance instructions for each system and its equipment. Instruction shall consist of a minimum of four 8-hour periods over consecutive days and shall be 30% classroom and 70% at site location. Coordinate scheduling of instruction times with Owner's operators.
- B. Specific Data: Submit four complete sets of the following data to the Owner for approval and commissioning agent for review prior to acceptance of the installation, complete and at one time; (partial or separate data will not be accepted) data shall consist of the following:
 - 1. Valve Directory: Indicating valve number, location, function and normal operating position for each.
 - 2. Color code schedule.
 - 3. Equipment: List of name plates, including name plate data.

4. **Manufacturer's Literature:** Copies of manufacturer's instructions for operation and maintenance of all mechanical equipment, including replacement parts lists and drawings. Mark or highlight brochure literature indicating the models, sizes, capacities, curve operating points, etc., in a manner to clearly indicate the equipment installed. Remove all pages or sheets from the bulletin and catalogs that do not pertain to equipment installed on the project.
5. **Written Instructions:** Typewritten instructions for operation and maintenance of the system composed of OPERATING INSTRUCTIONS, MAINTENANCE INSTRUCTIONS and a MAINTENANCE SCHEDULE.
 - a. OPERATING INSTRUCTIONS shall contain a brief description of the system. Adjustments requiring the technical knowledge of the service agency personnel shall not be included in the operating instructions. The fact such adjustments are required, however, shall be noted.
 - b. MAINTENANCE INSTRUCTIONS shall list each item of equipment requiring inspection, lubrication or service and describe the performance of such maintenance.
 - c. MAINTENANCE SCHEDULE shall list each item of equipment requiring maintenance, shall show the exact type of maintenance on every component of each item of equipment, and shall show when each item of equipment should be inspected or services.
6. **Instructions:** Operating personnel shall be instructed in the operation of the system in accordance with typewritten, approved instructions.
- C. **Binders:** Provide complete sets of the above data in loose-leaf ring-type binders with permanent covers, with identification on front and on spine.

1.24 SPECIAL REQUIREMENTS

- A. During the guarantee period and as directed by the Owner, make any additional tests, adjustment, etc., that may be required and correct any defects or deficiencies arising from operation of the systems. Operational tests shall be made during both heating and cooling seasons and on all systems.
- B. **Completion:**
 1. The entire mechanical system shall be commissioned in accordance with ASHRAE Guideline 1-1996 and the requirements of this specification. A final commissioning report shall be approved by the Owner, Architect, and Mechanical Engineer prior to final acceptance of the work.
 2. When the installation is complete and adjustments specified herein have been made, the system, shall be operated for a period of one week, during which time it shall be demonstrated to the Owner or his representative as being completed and operating in conformance with these specifications. The Contractor shall schedule all work so that this time period, which is to confirm a "bug-free" system, will occur before the total project is accepted for substantial completion by Owner.
 3. The work hereunder shall not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, valve directories, piping identification code directory, and nameplates specified herein have been approved and properly posted in the building.

1.25 WARRANTY/GUARANTEE

- A. The contractor shall warranty/guarantee that materials, apparatus, and equipment furnished and installed under the mechanical division of these specifications shall be new and free from all defects. Should any defects develop, within one year (unless a longer period is listed in other sections of the specifications) from the date of final acceptance by the owner or from the date of certificate of substantial completion, whichever is earlier, due to inferior or faulty materials and/or workmanship, the trouble shall be corrected by this Contractor without expense to the Owner. Any defective materials or inferior workmanship noticed at the time of installation or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.
- B. The work shall be installed of such materials and in such a manner that:
 - 1. The operation of all parts of the system shall be noiseless to the extent that no objectionable sound of operation will be heard outside of the rooms enclosing the apparatus or equipment.
 - 2. Apparatus or equipment shall operate in accordance with detailed specifications covering each item.
 - 3. Contractor shall, at his own expense, make any adjustments or changes required to produce a condition of quietness satisfactory to the Engineer or his representative. Such adjustments or changes shall not reduce the performance or quantities called for on the drawings.
 - 4. Contractor shall guarantee that his installation of all materials and equipment will meet the performance requirements of these specifications and that all equipment will deliver the specified or required capacities.
 - 5. The Owner reserves the right to make temporary or emergency repairs as necessary to keep equipment in operating condition without voiding the guarantee contained herein nor relieving the Contractor of his responsibilities during the guarantee period.
 - 6. Contractor shall be responsible for all damage to any part of the premises caused by leaks or break in pipe lines, fixtures or equipment furnished and installed under his contract for a period of one year after date of acceptance of the project by Owner. He shall replace in kind, at his own expense, any and all items so damaged to the complete satisfaction of the Owner.

END OF SECTION

SECTION 23 00 50
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete base construction requirements.
 - 3. Escutcheons.
 - 4. Dielectric fittings.
 - 5. Flexible connectors.
 - 6. Mechanical sleeve seals.
 - 7. Equipment nameplate data requirements.
 - 8. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Identification for HVAC Piping and Equipment."
 - 9. Nonshrink grout for equipment installations.
 - 10. Field-fabricated metal and wood equipment supports.
 - 11. Installation requirements common to equipment specification sections.
 - 12. Cutting and patching.
 - 13. Touchup painting and finishing.
- B. Pipe and pipe fitting materials are specified in Division 23 piping system Sections.
- C. Related Sections include the following:
 - 1. Division 1 Section "LEED Requirements".

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, crawl spaces, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- 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.
- F. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.03 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
- B. LEED Submittals: Provide cost data breakdown, recycle content and manufacturer name and location.
- C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- D. Coordination Drawings: For access panel and door locations.
- E. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
 1. Planned piping layout, including valve and specialty locations and valve-stem movement.
 2. Clearances for installing and maintaining insulation.
 3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 4. Equipment and accessory service connections and support details.
 5. Exterior wall and foundation penetrations.
 6. Fire-rated wall and floor penetrations.
 7. Sizes and location of required concrete pads and bases.
 8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
- F. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.04 QUALITY ASSURANCE

- A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.05 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 prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.06 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dielectric Unions:
 - a. Epco Sales Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Industries, Inc.; Wilkins Div.
 - 2. Dielectric Flanges:
 - a. Epco Sales Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - 3. Dielectric-Flange Insulating Kits:
 - a. Calpico, Inc.

- b. Central Plastics Co.
- 4. Dielectric Couplings:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- 5. Dielectric Nipples:
 - a. Grinnell Corp.; Grinnell Supply Sales Co.
 - b. Victaulic Co. of America.
- 6. Mechanical Sleeve Seals:
 - a. Calpico, Inc.
 - b. Metraflex Co.
 - c. Thunderline/Link-Seal.

2.02 PIPE AND PIPE FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. Alloy E: Approximately 95 percent tin and 5 percent antimony, lead free.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- I. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.04 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.
- G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- H. 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.

2.05 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.06 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with setscrews.
 5. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 - 2. OD: Completely cover opening.
 - 3. Cast Brass: Split casting, with concealed hinge and set screw.
 - a. Finish: Rough brass.
 - b. Finish: Polished chrome-plate.
 - 4. Stamped Steel: One piece, with spring clips and chrome-plated finish.
 - 5. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
 - 6. Cast-Iron Floor Plate: One-piece casting.

2.07 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psig, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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 at indicated slope.
- D. Install components with pressure rating equal to or greater than system operating pressure.
- E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends.
- G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.

- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - 1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
 - 2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
 - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - 4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
 - 5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
- N. Sleeves are not required for core drilled holes.
- O. Permanent sleeves are not required for holes formed by PE removable sleeves.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Build sleeves into walls and slabs as work progresses.
 - 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
 - b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Sections for flashing.
 - 1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Sections for materials.
 - 5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve 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 in diameter and larger.

3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Sections for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 5. 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:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. 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.
 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and

gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

- W. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
 2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
 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.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical 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.
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.03 PAINTING AND FINISHING

- A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.
- B. Apply paint to exposed piping according to the following, unless otherwise indicated:
 1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
 5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.

- 6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- C. Paint visible sheet metal behind ceiling inlets and outlets flat black.
- D. Do not paint piping specialties with factory-applied finish.
- E. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.05 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.06 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical 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.

3.07 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.08 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

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 NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

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. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.

- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 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. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

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 18
ESCUTCHEONS FOR HVAC 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. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- B. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet 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 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 or split-plate, stamped-steel type with exposed-rivet hinge.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Two-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
 - e. Bare Piping in Equipment Rooms: Caulk annular space.

- C. 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: Two-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

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 hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
 - 3. Division 23 Section "Metal Ducts" for duct hangers and supports.

1.02 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7 & 1615A.1.21 of CBC.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
- 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. Pipe stands. Include Product Data for components.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding Certificates.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

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. 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. Grinnell Corp.
 - 3. 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. Unistrut Corp.; Tyco International, Ltd.
 - 4. Tolco, Inc.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- 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. ERICO/Michigan Hanger Co.
 - 2. Pipe Shields, Inc.
 - 3. Rilco Manufacturing Company, 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. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.

- b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or 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.

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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 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.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- 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. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 5. 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.
 6. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- 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. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 - 6. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 - 7. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- 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 powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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 for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- 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 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.
- 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 B31.1 (for power piping) and 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 B31.1 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.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
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.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- 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 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation mounts.
 - 2. Housed-restrained-spring isolators.
 - 3. Spring hangers.
 - 4. Snubbers.
 - 5. Restraint cables.
 - 6. Seismic-restraint accessories.
 - 7. Mechanical anchor bolts.
 - 8. Adhesive anchor bolts.
- B. Related Requirements:
 - 1. Section 22 05 48 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.02 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - 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. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic and wind restraints and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 3. 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 was examined for excessive stress and that none exists.
 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. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.
- D. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number 0349 & 0198 from OSHPD, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: A.
 - 2. Assigned Seismic Use Group or Building Category as Defined under Structural specifications.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 1.5.
 - c. Component Amplification Factor: 1.0.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
 - 4. Design Spectral Response Acceleration at 1.0-Second Period.
 - 5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - a. 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 are subjected.

2.02 ELASTOMERIC ISOLATION MOUNTS

- A. Double-Deflection, Elastomeric Isolation Mounts:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Isolation.
 - 2. Mounting Plates:

- a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
- b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.03 HOUSED-RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Eliminator Co., Inc.
 2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
 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.

2.04 SPRING HANGERS

Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Mason Industries, Inc.
 - b. Vibration Eliminator Co., Inc.
 - c. Vibration Isolation.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.05 SNUBBERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Insert manufacturer's name; product name or designation or comparable product by one of the following:
 1. Kinetics Noise Control, Inc.
 2. Mason Industries, Inc.
 3. Vibration Mountings & Controls, Inc.
- B. Description: 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.

2.06 RESTRAINT CHANNEL BRACINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Cooper B-Line, Inc.
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Unistrut.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.07 RESTRAINT CABLES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Kinetics Noise Control, Inc.
 2. Loos & Co., Inc.
 3. Vibration Mountings & Controls, Inc.

- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.08 SEISMIC-RESTRAINT ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Mason Industries, Inc.
 - 3. TOLCO.
- B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.09 MECHANICAL ANCHOR BOLTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hilti, Inc.
 - 3. Kinetics Noise Control, Inc.
 - 4. Mason Industries, Inc.
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.10 ADHESIVE ANCHOR BOLTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Hilti, Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and

stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.01 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 of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. 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.
- B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.03 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete." or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Install cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- 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 Section 23 21 13 "Hydronic 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 post connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. Test and adjust restrained-air-spring isolator controls and safeties.

- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.06 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.

END OF SECTION

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.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. 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.

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

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White
 - 3. Background Color: Black
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- 7. Fasteners: Stainless-steel self-tapping screws.
- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's 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
- 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 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.

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.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.
3. Balancing steam systems.
4. Testing, Adjusting, and Balancing Equipment:
 - a. Heat exchangers.
 - b. Motors.
 - c. Chillers.
 - d. Cooling towers.
 - e. Condensing units.
 - f. Boilers.
 - g. Heat-transfer coils.
5. Testing, adjusting, and balancing existing systems and equipment.
6. Sound tests.
7. Vibration tests.
8. Duct leakage tests.
9. Control system verification.

1.02 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.03 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.04 ACTION SUBMITTALS

- A. LEED Submittals:
 - 1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - 2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. 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.

1.06 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABCor NEBB
 2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
 - C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.07 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

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.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in

AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design."
Compare results with the design data and installed conditions.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. 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. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.
 - d. Systems are flushed, filled, and air purged.
 - e. Strainers are pulled and cleaned.
 - f. Control valves are functioning per the sequence of operation.
 - g. Shutoff and balance valves have been verified to be 100 percent open.
 - h. Pumps are started and proper rotation is verified.
 - i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
 - j. Variable-frequency controllers' startup is complete and safeties are verified.
 - k. Suitable access to balancing devices and equipment is provided.

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 Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.

- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. 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 occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
 - 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 - 2. Re-measure and confirm that total airflow is within design.
 - 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 - 4. Mark all final settings.
 - 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 - 6. Measure and record all operating data.
 - 7. Record final fan-performance data.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:
 - 1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
 - 2. Verify that the system is under static pressure control.
 - 3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - 4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.

- c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
 - g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
- a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
- a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.

9. Verify final system conditions as follows:
 - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.07 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 1. Check liquid level in expansion tank.
 2. Check highest vent for adequate pressure.
 3. Check flow-control valves for proper position.
 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 5. Verify that motor starters are equipped with properly sized thermal protection.
 6. Check that air has been purged from the system.

3.08 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.

- e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - 3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - 1. Measure flow in main and branch pipes.
 - 2. Adjust main and branch balance valves for design flow.
 - 3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - 1. Measure flow at terminals.
 - 2. Adjust each terminal to design flow.
 - 3. Re-measure each terminal after it is adjusted.
 - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - 5. Perform temperature tests after flows have been balanced.
- D. For systems with pressure-independent valves at terminals:
 - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
 - 2. Perform temperature tests after flows have been verified.
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - 1. Measure and balance coils by either coil pressure drop or temperature method.
 - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- F. Verify final system conditions as follows:
 - 1. Re-measure and confirm that total water flow is within design.
 - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 3. Mark final settings.
- G. Verify that memory stops have been set.

3.09 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.

- 2) Measure flow by main flow meter, if installed.
- 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
- b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
- c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
6. Prior to verifying final system conditions, determine the system differential-pressure set point.

7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 8. Mark final settings and verify that all memory stops have been set.
 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 10. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
 3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.

- b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
 9. Prior to verifying final system conditions, determine system differential-pressure set point.
 10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 11. Mark final settings and verify that memory stops have been set.
 12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 13. Verify that memory stops have been set.

3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first.
- B. Balance the secondary circuits after the primary circuits are complete.
- C. Adjust pumps to deliver total design gpm.
 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 2. Measure pump TDH as follows:

- a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- D. Adjust flow-measuring devices installed in mains and branches to design water flows.
1. Measure flow in main and branch pipes.
 2. Adjust main and branch balance valves for design flow.
 3. Re-measure each main and branch after all have been adjusted.
- E. Adjust flow-measuring devices installed at terminals for each space to design water flows.
1. Measure flow at terminals.
 2. Adjust each terminal to design flow.
 3. Re-measure each terminal after it is adjusted.
 4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 5. Perform temperature tests after flows have been balanced.
- F. For systems with pressure-independent valves at terminals:
1. Measure differential pressure and verify that it is within manufacturer's specified range.
 2. Perform temperature tests after flows have been verified.
- G. For systems without pressure-independent valves or flow-measuring devices at terminals:
1. Measure and balance coils by either coil pressure drop or temperature method.
 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- H. Verify final system conditions as follows:
1. Re-measure and confirm that total water flow is within design.
 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 3. Mark final settings.
- I. Verify that memory stops have been set.

3.11 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.

- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.12 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Phase and hertz.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter size and thermal-protection-element rating.
 - 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.13 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.14 PROCEDURES FOR BOILERS

- A. Hydronic Boilers:
 - 1. Measure and record entering- and leaving-water temperatures.
 - 2. Measure and record water flow.
 - 3. Record relief valve pressure setting.

3.15 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
- B. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.

2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Airflow.
 3. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.

3.16 SOUND TESTS

- A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at 15 locations as designated by the Architect.
- B. Instrumentation:
1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
 2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
 3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
 4. The accuracy of the sound-testing meter shall be plus or minus one decibel.
- C. Test Procedures:
1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
 2. Equipment should be operating at design values.
 3. Calibrate the sound-testing meter prior to taking measurements.
 4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
 5. Record a set of background measurements in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
 6. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
 7. Take readings no closer than 36 inches (900 mm) from a wall or from the operating equipment and approximately 60 inches (1500 mm) from the floor, with the meter held or mounted on a tripod.

8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:
 - a. Location.
 - b. System tested.
 - c. dBA reading.
 - d. Sound pressure level in each octave band with equipment on and off.
2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.17 VIBRATION TESTS

- A. After systems are balanced and construction is Substantially Complete, measure and record vibration levels on equipment having motor horsepower equal to or greater than 10.

B. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
4. Verify calibration date is current for vibration meter before taking readings.

C. Test Procedures:

1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
4. Record CPM or rpm.
5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:

1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.
3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart

from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."

4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.18 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

3.19 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 1. Verify temperature control system is operating within the design limitations.
 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 3. Verify that controllers are calibrated and function as intended.
 4. Verify that controller set points are as indicated.
 5. Verify the operation of lockout or interlock systems.
 6. Verify the operation of valve and damper actuators.
 7. Verify that controlled devices are properly installed and connected to correct controller.
 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.20 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
 2. Air Outlets and Inlets: Plus or minus 10 percent
 3. Heating-Water Flow Rate: Plus or minus 10 percent
 4. Cooling-Water Flow Rate: Plus or minus 10 percent
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.21 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.22 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.

- e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Filter static-pressure differential in inches wg (Pa).
 - f. Preheat-coil static-pressure differential in inches wg (Pa).
 - g. Cooling-coil static-pressure differential in inches wg (Pa).
 - h. Heating-coil static-pressure differential in inches wg (Pa).
 - i. Outdoor airflow in cfm (L/s).
 - j. Return airflow in cfm (L/s).
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- F. Apparatus-Coil Test Reports:
1. Coil Data:
- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch (mm) o.c.
 - f. Make and model number.
 - g. Face area in sq. ft. (sq. m).
 - h. Tube size in NPS (DN).
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Airflow rate in cfm (L/s).
 - b. Average face velocity in fpm (m/s).
 - c. Air pressure drop in inches wg (Pa).
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
 - e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
 - f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).

- h. Water flow rate in gpm (L/s).
 - i. Water pressure differential in feet of head or psig (kPa).
 - j. Entering-water temperature in deg F (deg C).
 - k. Leaving-water temperature in deg F (deg C).
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig (kPa).
 - n. Refrigerant suction temperature in deg F (deg C).
 - o. Inlet steam pressure in psig (kPa).
- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
- 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h (kW).
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches (mm), and bore.
 - n. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - 2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Entering-air temperature in deg F (deg C).
 - c. Leaving-air temperature in deg F (deg C).
 - d. Air temperature differential in deg F (deg C).
 - e. Entering-air static pressure in inches wg (Pa).
 - f. Leaving-air static pressure in inches wg (Pa).
 - g. Air static-pressure differential in inches wg (Pa).
 - h. Low-fire fuel input in Btu/h (kW).
 - i. High-fire fuel input in Btu/h (kW).
 - j. Manifold pressure in psig (kPa).

- k. High-temperature-limit setting in deg F (deg C).
 - l. Operating set point in Btu/h (kW).
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h (kW).
- H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
- 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h (kW).
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Airflow rate in cfm (L/s).
 - i. Face area in sq. ft. (sq. m).
 - j. Minimum face velocity in fpm (m/s).
 - 2. Test Data (Indicated and Actual Values):
 - a. Heat output in Btu/h (kW).
 - b. Airflow rate in cfm (L/s).
 - c. Air velocity in fpm (m/s).
 - d. Entering-air temperature in deg F (deg C).
 - e. Leaving-air temperature in deg F (deg C).
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches (mm), and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Suction static pressure in inches wg (Pa).
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Indicated airflow rate in cfm (L/s).
 - h. Indicated velocity in fpm (m/s).
 - i. Actual airflow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- K. Air-Terminal-Device Reports:
 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.

- g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft. (sq. m).
2. Test Data (Indicated and Actual Values):
- a. Airflow rate in cfm (L/s).
 - b. Air velocity in fpm (m/s).
 - c. Preliminary airflow rate as needed in cfm (L/s).
 - d. Preliminary velocity as needed in fpm (m/s).
 - e. Final airflow rate in cfm (L/s).
 - f. Final velocity in fpm (m/s).
 - g. Space temperature in deg F (deg C).
- L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Entering-water temperature in deg F (deg C).
 - c. Leaving-water temperature in deg F (deg C).
 - d. Water pressure drop in feet of head or psig (kPa).
 - e. Entering-air temperature in deg F (deg C).
 - f. Leaving-air temperature in deg F (deg C).
- M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm (L/s).
 - g. Water pressure differential in feet of head or psig (kPa).
 - h. Required net positive suction head in feet of head or psig (kPa).
 - i. Pump rpm.

- j. Impeller diameter in inches (mm).
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in feet of head or psig (kPa).
 - b. Pump shutoff pressure in feet of head or psig (kPa).
 - c. Actual impeller size in inches (mm).
 - d. Full-open flow rate in gpm (L/s).
 - e. Full-open pressure in feet of head or psig (kPa).
 - f. Final discharge pressure in feet of head or psig (kPa).
 - g. Final suction pressure in feet of head or psig (kPa).
 - h. Final total pressure in feet of head or psig (kPa).
 - i. Final water flow rate in gpm (L/s).
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- N. Instrument Calibration Reports:
1. Report Data:
- a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.23 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.
- B. Commissioning authority 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.
- C. 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."
- D. 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.

- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall 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 specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

3.24 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13 DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes semirigid and flexible duct, and plenum, insulation; insulating cements; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 07 Sections for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 23 Section "HVAC Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
 - 3. Division 23 Insulation Sections for insulation for piping systems.
 - 4. Division 23 Section "Metal Ducts" for duct liner.

1.02 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Removable insulation sections at access panels.
 - 2. Application of field-applied jackets.
 - 3. Applications at linkages for control devices.
- C. 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.
- D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.05 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.06 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.

2.02 INSULATION MATERIALS

- A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.03 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8-oz./sq. yd.
 - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 - 2. Galvanized Steel: 0.005 inch thick.
 - 3. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
- D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
 - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts and plenums; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.

2.04 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.
- B. 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 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.

3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 1. Seal penetrations with vapor-retarder mastic.
 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 3. Seal insulation to roof flashing with vapor-retarder mastic.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.04 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, 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 anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 4. Impale insulation over anchors and attach speed washers.

5. 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.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.05 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09 Painting Sections.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.06 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
 1. Indoor concealed supply-, return-, and outside-air ductwork.
 2. Indoor exposed supply-, return-, and outside-air ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 1. Fibrous-glass ducts.
 2. Metal ducts with duct liner.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 5. Flexible connectors.
 6. Vibration-control devices.
 7. Testing agency labels and stamps.
 8. Nameplates and data plates.
 9. Access panels and doors in air-distribution systems.

3.07 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Concealed, round and rectangular, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- C. Concealed, round and rectangular, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- D. Concealed, supply-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- E. Concealed, return-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- F. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
 - 3. Mineral-Fiber Pipe and Tank: 3 inches (75 mm) thick.
- G. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- H. Exposed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- I. Exposed, rectangular, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
- J. Exposed, supply-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

- K. Exposed, return-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Section 01 91 13 "General Commissioning Requirements" for general commissioning process requirements.

1.02 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.03 INFORMATIONAL SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

1.04 ALLOWANCES

- A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Section 01 21 00 "Allowances."

1.05 UNIT PRICES

- A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Section 01 22 00 "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.

- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.07 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of Work are complete.
- D. Provide test data, inspection reports, and certificates in Systems Manual.

1.08 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
 - 5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
 - 6. Test and inspection reports and certificates.
 - 7. Corrective action documents.
 - 8. Verification of testing, adjusting, and balancing reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TESTING PREPARATION

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.02 Testing AND BALANCING VERIFICATION

- A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.03 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments.

Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.04 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in HVAC boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 23 09 00 "Instrumentation and Control for HVAC" and Section 23 09 93 "Sequence and Operations for HVAC Controls." Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in HVAC piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chilled and hot-water systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special

exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

- G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION

SECTION 23 09 00
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials, equipment, and service necessary for a complete and operating temperature control system, utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.
- B. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
- C. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.02 SYSTEM DESCRIPTION

- A. The entire temperature control system shall be comprised of a network of interoperable, stand-alone digital controllers communicating via BacNet communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be manufactured by Honeywell. Equivalent BacNet products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.
- B. The Temperature Control System as provided in this Division shall be based on the Honeywell WEBs System incorporating the Niagara Framework™. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara Framework platform are unacceptable.

1.03 SUBMITTAL

- A. Two copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.
- B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.
- C. Submittal shall also include a complete point list of all points to be connected to the temperature control system. Controls Contractor shall provide necessary point lists, protocol documentation, and factory support information for systems provided.
- D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this

stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.

- E. Include the following display graphics for each of the sites (where applicable):
 - 1. Site plan view of entire campus identifying each building.
 - 2. Individual buildings, including room layout with display of all space temperatures and occupied mode, outside air temperature & humidity.
 - 3. Mechanical equipment display for each AC unit to include space temperature, heating and cooling setpoints, supply air temperature, fan status, occupied mode, outside temperature & humidity.
 - 4. Boiler and hot water pumps showing all related points.
 - 5. Page showing all room temperatures, room temperature setpoints, occupied mode, AC unit fan status and AC unit mode (heating or cooling).
- F. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Two copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Controls Contractor shall provide as-builts for their portions of work.

1.04 SPECIFICATION NOMENCLATURE

- A. Acronyms used in this specification are as follows:

NAC Network Area Controller

IDC Interoperable Digital Controller

IBC Interoperable BACnet Controller

GUI Graphical User Interface

WBI Web Browser Interface

POT Portable Operator's Terminal

PMI Power Measurement Interface

DDC Direct Digital Controls

LAN Local Area Network

WAN Wide Area Network

OOT Object Oriented Technology

PICS Product Interoperability Compliance Statement

1.05 AGENCY AND CODE APPROVALS

- A. All products of the temperature control system shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided

with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916; Energy Management Systems
2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "signal Equipment"
3. CE
4. FCC, Part 15, Subpart J, Class A Computing Devices

1.06 SOFTWARE LICENSE AGREEMENT

- A. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
- B. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner. The owner shall determine which organizations to be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.08 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

PART 2 - MATERIALS

2.01 ACCEPTABLE CONTROL MANUFACTURER / CONTRACTOR

- A. Honeywell "Authorized Controls Integrator" – R & R Controls Inc.
4564 B Alvarado Canyon Road
San Diego, CA 92120
Phone: 619-516-1880
Fax: 619 516-1881

2.01 GENERAL

- A. The temperature control system shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein. All systems and software within temperature control system shall be supported by compliance documentation from the manufacturer.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall temperature control system.

2.02 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.
- B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device’s compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.
- C. All components and controllers supplied under this Division shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Systems employing a “flat” single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.03 NETWORKS

- A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data

with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

- B. Local area network minimum physical and media access requirements:
 - 1. Ethernet; IEEE standard 802.3
 - 2. Cable; 100 Base-T, UTP-8 wire, category 5
 - 3. Minimum throughput; 100 Mbps.

2.04 NETWORK ACCESS

- A. Remote Access.
 - 1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.05 NETWORK AREA CONTROLLER (NAC)

- A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and also provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
 - 1. Calendar functions
 - 2. Scheduling
 - 3. Trending
 - 4. Alarm monitoring and routing
 - 5. Time synchronization
 - 6. Integration of LonWorks controller data and BACnet controller data
 - 7. Network Management functions for all LonWorks based devices
- B. The Network Area Controller must provide the following hardware features as a minimum:
 - 1. One Ethernet Port – 10/100 Mbps
 - 2. One RS-232 port
 - 3. One LonWorks Interface Port – 78KB FTT-10A
 - 4. One RS-485 ports
 - 5. Battery Backup
 - 6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 - 7. The NAC must be capable of operation over a temperature range of 32 to 122°F
 - 8. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
 - 9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

- C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.
- E. Event Alarm Notification and actions
 - 1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
 - 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 - d. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 - 4. Provide timed (schedule) routing of alarms by class, object, group, or node.
 - 5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- F. Control equipment and network failures shall be treated as alarms and annunciated.
- G. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1. Screen message text
 - 2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 - 3. Pagers via paging services that initiate a page on receipt of email message
 - 4. Graphic with flashing alarm object(s)
 - 5. Printed message, routed directly to a dedicated alarm printer
- H. The following shall be recorded by the NAC for each alarm (at a minimum):
 - 1. Time and date
 - 2. Location (building, floor, zone, office number, etc.)
 - 3. Equipment (air handler #, access way, etc.)
 - 4. Acknowledge time, date, and user who issued acknowledgement.
 - 5. Number of occurrences since last acknowledgement.

- I. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- L. Provide a “query” feature to allow review of specific alarms by user-defined parameters.
- M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.06 DATA COLLECTION AND STORAGE

- A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
- B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - 1. Designating the log as interval or deviation.
 - 2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - 3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - 4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - 5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.
- D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- E. All log data shall be available to the user in the following data formats:
 - 1. HTML
 - 2. XML
 - 3. Plain Text
 - 4. Comma or tab separated values
- F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
- G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:

1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached it's user-defined capacity of data stores
4. Provide ability to clear logs once archived

2.07 AUDIT LOG

- A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
 1. Time and date
 2. User ID
 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.08 DATABASE BACKUP AND STORAGE

- A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.09 INTEROPERABLE DIGITAL CONTROLLER (IDC)

- A. Controls shall be Honeywell Spyder microprocessor based Interoperable BacNet Controllers (IDC) or approved equal. Where possible, all Interoperable Digital Controllers shall bear the applicable BacNet™ BLT logo on each product delivered.
- B. HVAC control shall be accomplished using BacNet™ based devices where the application has a BacNet profile defined. The Controls Contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.
- C. The Controls Contractor shall run the BacNet network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the BacNet wiring guidelines, are not exceeded. A maximum of 32 devices may occupy any one BacNet trunk and must be installed using the appropriate trunk termination device. All BacNet devices must be supplied using BacNet MSTP communications transceivers.
- D. The Network Area Controller (NAC) will provide all scheduling, alarming, trending, and network management for the BacNet based devices.
- E. The IDCs shall communicate with the NAC at a baud rate of not less than 38.4K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

- F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 1% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- G. The Controls Contractor supplying the IDC's shall provide documentation for each device, with the following information at a minimum:
 - 1. Network Variable Inputs; name and type
 - 2. Network Variable Outputs; name and type
 - 3. Network configuration parameters; name and type
- H. It is the responsibility of the Division 15 contractor to ensure that the proper Network Inputs and Outputs are provided in each IDC, as required by the point charts.
- I. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.
- J. GRAPHICAL USER INTERFACE SOFTWARE
- K. Operating System: *WEBSTATION-AX™*
- L. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- M. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
 - 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
 - 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 - 3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
 - 4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
 - 5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
- N. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
1. Create, delete or modify control strategies.
 2. Add/delete objects to the system.
 3. Tune control loops through the adjustment of control loop parameters.
 4. Enable or disable control strategies.
 5. Generate hard copy records or control strategies on a printer.
 6. Select points to be alarmable and define the alarm state.
 7. Select points to be trended over a period of time and initiate the recording of values automatically.
- O. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
- P. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- Q. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- R. Alarm Console
1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
 2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.10 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring

additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
- D. The Web browser client shall support at a minimum, the following functions:
 - 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
 - 2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
 - 3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
 - 4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
 - 5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
 - 6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - b. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - c. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - d. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - e. View logs and charts
 - f. View and acknowledge alarms
 - g. Setup and execute SQL queries on log and archive information
- E. The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

1. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.11 SERVER FUNCTIONS AND HARDWARE

- A. The central server is located at the Grossmont Union High School District's Maintenance Office. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.
- B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.
- C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.
- D. The server shall provide the following functions, at a minimum:
 1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
 2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
 3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
 4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
 5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
 6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
 7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
 8. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
 9. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
 - a. Routing of alarms to display, printer, email and pagers
 - b. View and acknowledge alarms
 - c. Query alarm logs based on user-defined parameters
 10. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:

- a. Viewing and printing log data
- b. Exporting log data to other software applications
- c. Query log data based on user-defined parameters

2.12 SYSTEM PROGRAMMING

- A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide “real-time” data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.
- C. Programming Methods
 - 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 - 2. Configuration of each object will be done through the object’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
 - 3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
 - 4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
 - 5. The system shall support object duplication within a customer’s database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.13 NETWORK MANAGEMENT

- A. The Graphical User Interface software (GUI) shall provide a complete set of integrated BacNet network management tools for working with BacNet networks. These tools shall manage a

database for all BacNet devices by type and revision and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between BacNet devices, known as “binding”.

- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing BacNet network, regardless of what network management tool(s) were used to install the existing network, so that existing BacNet devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.
- F. Standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- G. The objects in this library shall be capable of being copied and pasted into the user’s database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- H. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- I. All control objects shall conform to the control objects specified in the BACnet specification.
- J. The library shall include applications or objects for the following functions, at a minimum:
 - 1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
 - 2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical “point-and-click” selection. This object must be “linkable” to any or all scheduling objects for effective event control.
 - 3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
 - 4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
 - 5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take

advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.

6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.
- K. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.
1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time de`lay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
 3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
 4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
 5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.

6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
 7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
 8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
 9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
 7. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
 8. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.
- L. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
 2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device

manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.

3. For BACnet devices, provide the following objects at a minimum:
 - a. Analog In
 - b. Analog Out
 - c. Analog Value
 - d. Binary
 - e. Binary In
 - f. Binary Out
 - g. Binary Value
 - h. Multi-State In
 - i. Multi-State Out
 - j. Multi-State Value
 - k. Schedule Export
 - l. Calendar Export
 - m. Trend Export
 - n. Device
4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
5. For BACnet devices, provide the following support at a minimum
 - a. Segmentation
 - b. Segmented Request
 - c. Segmented Response
 - d. Application Services
 - e. Read Property
 - f. Read Property Multiple
 - g. Write Property
 - h. Write Property Multiple
 - i. Confirmed Event Notification
 - j. Unconfirmed Event Notification
 - k. Acknowledge Alarm
 - l. Get Alarm Summary
 - m. Who-has
 - n. I-have
 - o. Who-is
 - p. I-am
 - q. Subscribe COV

- r. Confirmed COV notification
- s. Unconfirmed COV notification
- t. Media Types
- u. Ethernet
- v. BACnet IP Annex J
- w. MSTP
- x. BACnet Broadcast Management Device (BBMD) function
- y. Routing

2.14 MODBUS SYSTEM INTEGRATION

- A. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
- B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the EMS. Objects provided shall include at a minimum:
 - 1. Read/Write Modbus AI Registers
 - 2. Read/Write Modbus AO Registers
 - 3. Read/Write Modbus BI Registers
 - 4. Read/Write Modbus BO Registers
- C. The Network Area Controller shall perform all scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices.
- D. The Controls Contractor shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning

2.15 OTHER CONTROL SYSTEM HARDWARE

- A. Space Temperature Wall Module. Wall Module shall be Honeywell or equivalent.
 - 1. Wall module shall have a 20K Ohm NTC thermistor temperature sensor with operating range of 45 to 99 F under a locking cover/enclosure with UL 916 listing designed for mounting on a standard electrical switch box.
 - 2. Space temperature sensors shall be accurate to plus or minus one F degree.
 - 3. Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments
 - 4. Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.
 - 5. Insulating foam shall be installed on the back of all space temperature wall modules to prevent air infiltration from wall opening.
- B. Duct Mount and Outside Air Temperature Sensors: Temperature sensors with an accuracy of +0.3° F. Temperature sensors shall be Honeywell or equivalent.

1. Outside air sensors shall include an integral sun shield.
 2. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
 3. Multipoint averaging element sensors shall be provided where specified and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
 4. Pipe mount sensors shall have copper, or stainless steel separable wells.
- C. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition and a current level below trip set point.
- D. Humidity Sensors. Humidity sensors shall be Honeywell or equivalent.
1. Duct and room sensors shall have a sensing range of 5% to 95%.
 2. Duct sensors shall be provided with a sampling chamber.
 3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall have a compensated ambient temperature range of -40°F to 170° F.
- E. Control Panels: Furnish control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All external wiring shall be connected to terminal strips mounted within the panel. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All work described in this section shall be performed by a Honeywell "Authorized Controls Integrator" that has a successful history in the design and installation of integrated control systems using Niagara Framework™. The installing contractor shall have a local office located within 20 miles from Grossmont Union High School District and a minimum of fifteen years of integration experience installing Honeywell DDC control systems and shall provide documentation in the submittal package verifying the company's experience.
- B. The Controls Contractor shall have employees at the local branch that are fully trained and certified for the Honeywell WEBs Systems incorporating Niagara Framework™. Copies of the employees Niagara Training Certificates shall be included in the submittals.
- C. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- D. Drawings of the temperature control system network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Owner shall be furnished and installed without additional cost.
- E. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.
- F. Controls Contractors shall have a C-10 License in good standing in the state of California.

3.02 WIRING

- A. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be installed in conduit and be the responsibility of the Controls Contractor.
- B. All wiring shall be in accordance with the National Electrical Code and any applicable local codes. All temperature control system wiring shall be installed in the conduit types allowed by the National Electrical Code or applicable local codes. Where plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.
- C. Direct Burial Cable shall be used for all underground communication bus wiring between buildings to prevent damage from moisture. The existing underground conduit systems are not watertight.

3.03 WARRANTY

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner.

3.04 WARRANTY ACCESS

- A. The Owner shall grant to this contractor, reasonable access to the temperature control system during the warranty period.
- B. The owner shall allow the contractor to access the temperature control system from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.05 SOFTWARE LICENSE

- A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner, or his appointed agent, shall determine which organizations to be named in the "orgid" of all Niagara Framework software licenses.
- B. The owner, or his appointed agent, shall be free to direct the modification of the "orgid" in any Niagara Framework software license, regardless of supplier.
- C. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.06 ACCEPTANCE TESTING

- A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and

perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

- B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- D. System Acceptance: Satisfactory completion is when this contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.07 OPERATOR INSTRUCTION, TRAINING

- A. During system commissioning and at such time acceptable performance of the temperature control system hardware and software has been established this contractor shall provide both off-site and on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by factory-trained personal that are familiar with the system hardware, software and accessories.
- B. This contractor shall provide 4 hours of instruction to the owner's designated personnel on the operation of the temperature control system and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation. Contractor to provide local training facility that will accommodate up to 12 school district employees.

PART 4 - SEQUENCES OF OPERATION

4.01 SEQUENCE OF OPERATION

- A. See controls drawings for any required sequences of operation.

PART 5 - POINT LISTS

5.01 SUMMARY

- A. The points shown on the controls drawings shall be accessible from the Graphical User Interface (GUI) and/or the Web browser interface (WBI). The supplier of the IDC and IBC devices shall ensure that the points listed in this table are accessible on their respective networks, by the Network Area Controller (NAC).

END OF SECTION

SECTION 23 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.
 - 5. Pressure regulators.

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, crawlspace, 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.
 - 2. Service Regulators: 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 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot (1:50).

2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.
- C. Delegated-Design Submittal: For natural-gas piping and equipment 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. Detail fabrication and assembly of seismic restraints.
 2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- C. Qualification Data: For qualified professional engineer.
- D. Welding certificates.
- E. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.07 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.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. 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.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.09 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

- B. 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 two 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 Owner's written permission.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

PART 2 - PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 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.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. OmegaFlex, Inc.
 - b. Parker Hannifin Corporation; Parflex Division.
 - c. Titeflex.
 - d. Tru-Flex Metal Hose Corp.
 - 2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - 3. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 5. Striker Plates: Steel, designed to protect tubing from penetrations.
 6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 7. Operating-Pressure Rating: 5 psig (34.5 kPa).
- C. 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.
 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or flanged or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

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.)
- B. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 3. Strainer Screen: 40 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

4. CWP Rating: 125 psig (862 kPa).
- C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

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.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

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: 125 psig (862 kPa).
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 6. 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: 125 psig (862 kPa).
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.

- d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated brass.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig (4140 kPa).
 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.
- E. PE Ball Valves: Comply with ASME B16.40.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: PE.
 3. Ball: PE.
 4. Stem: Acetal.
 5. Seats and Seals: Nitrile.
 6. Ends: Plain or fusible to match piping.
 7. CWP Rating: 80 psig (552 kPa).
 8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
 9. Operator: Nut or flat head for key operation.
 10. Include plastic valve extension.
 11. Include tamperproof locking feature for valves where indicated on Drawings.
- 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:
 - a. Vanguard Valves, Inc.
 - 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 3. Maximum Operating Pressure: 5 psig (34.5 kPa).
 - 4. Cast-aluminum body with nickel-plated chrome steel internal parts.
 - 5. Nitrile-rubber valve washer.
 - 6. Sight windows for visual indication of valve position.
 - 7. Threaded end connections complying with ASME B1.20.1.
 - 8. Wall mounting bracket with bubble level indicator.

2.06 PRESSURE REGULATORS

- A. General Requirements:
 - 1. Single stage and suitable for natural gas.
 - 2. Steel jacket and corrosion-resistant components.
 - 3. Elevation compensator.
 - 4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
- B. Service Pressure Regulators: Comply with ANSI Z21.80.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - d. Invensys.
 - e. Richards Industries; Jordan Valve Div.
 - 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 6. Orifice: Aluminum; interchangeable.
 - 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.

10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig (690 kPa).

2.07 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International Ltd.
 - e. Matco-Norca, Inc.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

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 36 inches (900 mm) below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 23 05 19 "Meters and Gages for HVAC Piping."

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 natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 5. 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.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.

- S. 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.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section 23 05 19 "Meters and Gages for HVAC Piping."
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

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 regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. 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. Brazed Joints: Construct joints according to AWS's "Braze Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. 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 seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- C. 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).

3.08 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. 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.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.09 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. 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 Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, 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. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Color: Gray.
 - 2. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Color: Gray.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) 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 (450-mm) 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. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as specified in Section 03 30 00 "Cast-in-Place Concrete."

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be the following:
 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; 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.
 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
 1. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 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.

3.17 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. One-piece, bronze ball valve with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
 - 1. One-piece, bronze ball valve with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. One-piece, bronze ball valve with bronze trim.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.02 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
 - 2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
 - 3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Hot-gas bypass valves.
 - 4. Filter dryers.
 - 5. Strainers.
 - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Shop Drawing Scale: 1/4 inch equals 1 foot (1:50).
 - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.07 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.08 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) or ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
 - 5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.02 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.
- B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.
- C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.
- D. 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.
- E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 (DN 25 to DN 40) and ductile iron for NPS 2 to NPS 3 (DN 50 to DN 80). Apply rust-resistant finish at factory.
 2. Gasket: Fiber asbestos free.
 3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
 4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
 5. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 6. Pressure Rating: Factory test at minimum 400 psig (2760 kPa).
 7. Maximum Operating Temperature: 330 deg F (165 deg C).
- F. Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
 2. End Connections:
 - a. NPS 2 (DN 50) and Smaller: With threaded-end connections.
 - b. NPS 2-1/2 (DN 65) and Larger: With flanged-end connections.
 3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
 5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.03 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 3. Operator: Rising stem and hand wheel.
 4. Seat: Nylon.
 5. End Connections: Socket, union, or flanged.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 275 deg F (135 deg C).
- B. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
 2. Packing: Molded stem, back seating, and replaceable under pressure.
 3. Operator: Rising stem.
 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 5. Seal Cap: Forged-brass or valox hex cap.
 6. End Connections: Socket, union, threaded, or flanged.
 7. Working Pressure Rating: 500 psig (3450 kPa).

8. Maximum Operating Temperature: 275 deg F (135 deg C).
- C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 3. Piston: Removable polytetrafluoroethylene seat.
 4. Closing Spring: Stainless steel.
 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 6. End Connections: Socket, union, threaded, or flanged.
 7. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
 8. Working Pressure Rating: 500 psig (3450 kPa).
 9. Maximum Operating Temperature: 275 deg F (135 deg C).
- D. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
 2. Core: Removable ball-type check valve with stainless-steel spring.
 3. Seat: Polytetrafluoroethylene.
 4. End Connections: Copper spring.
 5. Working Pressure Rating: 500 psig (3450 kPa).
- E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 3. Seat: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24, 115 or 208-V ac coil.
 6. Working Pressure Rating: 400 psig (2760 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Seat Disc: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Working Pressure Rating: 400 psig (2760 kPa).
 6. Maximum Operating Temperature: 240 deg F (116 deg C).
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.

2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Suction Temperature: 40 deg F (4.4 deg C).
 6. Superheat: Adjustable.
 7. Reverse-flow option (for heat-pump applications).
 8. End Connections: Socket, flare, or threaded union.
 9. Working Pressure Rating: 450 psig (3100 kPa).
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 5. Seat: Polytetrafluoroethylene.
 6. Equalizer: Internal or External.
 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24, 115 or 208-V ac coil.
 8. End Connections: Socket.
 9. Throttling Range: Maximum 5 psig (34 kPa).
 10. Working Pressure Rating: 500 psig (3450 kPa).
 11. Maximum Operating Temperature: 240 deg F (116 deg C).
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig (3450 kPa).
 5. Maximum Operating Temperature: 275 deg F (135 deg C).
- J. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
 2. Drain Plug: Brass hex plug.
 3. Screen: 100-mesh monel.
 4. End Connections: Socket or flare.
 5. Working Pressure Rating: 500 psig (3450 kPa).
 6. Maximum Operating Temperature: 275 deg F (135 deg C).
- K. Moisture/Liquid Indicators:
1. Body: Forged brass.

2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in ppm.
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- L. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina or charcoal.
 4. Designed for reverse flow (for heat-pump applications).
 5. End Connections: Socket.
 6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 7. Maximum Pressure Loss: 2 psig (14 kPa).
 8. Working Pressure Rating: 500 psig (3450 kPa).
 9. Maximum Operating Temperature: 240 deg F (116 deg C).
- M. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina or charcoal.
 4. Designed for reverse flow (for heat-pump applications).
 5. End Connections: Socket.
 6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 7. Maximum Pressure Loss: 2 psig (14 kPa).
 8. Working Pressure Rating: 500 psig (3450 kPa).
 9. Maximum Operating Temperature: 240 deg F (116 deg C).
- N. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
 2. End Connections: Socket or flare.
 3. Working Pressure Rating: 500 psig (3450 kPa).
 4. Maximum Operating Temperature: 275 deg F (135 deg C).
- O. Receivers: Comply with ARI 495.
1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 2. Comply with UL 207; listed and labeled by an NRTL.

3. Body: Welded steel with corrosion-resistant coating.
 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 5. End Connections: Socket or threaded.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 275 deg F (135 deg C).
- P. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
 2. End Connections: Socket or threaded.
 3. Working Pressure Rating: 500 psig (3450 kPa).
 4. Maximum Operating Temperature: 275 deg F (135 deg C).

2.04 REFRIGERANTS

- 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. Atofina Chemicals, Inc.
 2. DuPont Company; Fluorochemicals Div.
 3. Honeywell, Inc.; Genetron Refrigerants.
 4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Hot-Gas and Liquid Lines: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- D. Hot-Gas and Liquid Lines: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- E. Hot-Gas and Liquid Lines: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- F. Hot-Gas and Liquid Lines:
1. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 2. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 3. NPS 1-1/4 (DN 32) and Smaller: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

4. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- G. Hot-Gas and Liquid Lines NPS 2 to NPS 4 (DN 50 to DN 100): Schedule 40, black-steel and wrought-steel fittings with welded joints.
- H. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- I. Safety-Relief-Valve Discharge Piping: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- J. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- K. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- L. Safety-Relief-Valve Discharge Piping:
 1. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 2. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 3. NPS 1-1/4 (DN 32) and Smaller: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
 4. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- M. Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4 (DN 50 to DN 100): Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 1. Install valve so diaphragm case is warmer than bulb.
 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Hot-gas bypass valves.
 - 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge.
- M. Install flexible connectors at compressors.

3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 23 09 00 "Instrumentation and Control for HVAC" and Section 23 09 93 "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
 - 1. Shot blast the interior of piping.
 - 2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
 - 3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - 4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
 - 5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
 - 6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BA_g, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Threaded Joints: Thread steel 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. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.
- H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.05 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 7. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
 8. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
 9. NPS 4 (DN 100): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
 2. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9.5 mm).
 3. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (9.5 mm).
 4. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
- E. Support multifloor vertical runs at least at each floor.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.07 SYSTEM CHARGING

- A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
 4. Charge system with a new filter-dryer core in charging line.

3.08 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "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 and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
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 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
1. Liners and adhesives.
 2. Sealants and gaskets.
 3. Seismic-restraint devices.
- B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 2. Factory- and shop-fabricated ducts and fittings.
 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 4. Elevation of top of ducts.
 5. Dimensions of main duct runs from building grid lines.
 6. Fittings.
 7. Reinforcement and spacing.
 8. Seam and joint construction.
 9. Penetrations through fire-rated and other partitions.
 10. Equipment installation based on equipment being used on Project.
 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- 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.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.

- e. Access panels.
 - f. Perimeter moldings.
- B. Welding certificates.
 - C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports; AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports; and AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS 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.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 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 DOUBLE-WALL RECTANGULAR DUCTS AND 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. McGill AirFlow LLC.
 - 2. Sheet Metal Connectors, Inc.
- B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. 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."
- E. 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."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.
- H. Inner Duct: Minimum 0.028-inch (0.7-mm) perforated galvanized sheet steel having 3/32-inch- (2.4-mm-) diameter perforations, with overall open area of 23 percent or solid sheet steel.
- I. Formed-on Transverse Joints (Flanges): 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."
- J. 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."

2.03 SINGLE-WALL ROUND AND FLAT-OVAL 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. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
 - C. 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 (1524 mm) in Diameter: Flanged.
 - D. 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 (2286 mm) in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
 - E. 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."

2.04 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Lindab Inc.
 - 2. McGill AirFlow LLC.
 - 3. SEMCO Incorporated.
 - 4. Sheet Metal Connectors, Inc.

- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - 1. 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."
 - a. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.
 - 2. 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."
 - a. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
 - 3. 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."
- D. Inner Duct: Minimum 0.028-inch (0.7-mm) perforated galvanized sheet steel having 3/32-inch (2.4-mm-) diameter perforations, with overall open area of 23 percent, or solid sheet steel.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.

2.05 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 (Z275).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. 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.
- E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Factory- or Shop-Applied Antimicrobial Coating:
 - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
 - 2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - 5. Shop-Applied Coating Color: Black .
 - 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.06 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 available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA Inc.
 - b. Armacell LLC.
 - c. Rubatex International, LLC
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 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."
- 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- (2.6-mm-) 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel, aluminum or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- 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 (12.7 m/s).
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) 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 (12.7 m/s) or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.07 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 6 inches (152 mm).
 3. Sealant: Modified styrene acrylic.

4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.08 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 (Table 5-1M), "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.

2.09 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Kinetics Noise Control.
 2. Mason Industries.
 3. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or 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. 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 or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts

designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.01 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 (25 mm), 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 (38 mm).
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 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 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "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 (610 mm) of each elbow and within 48 inches (1200 mm) 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 (5 m).
 - 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.

3.05 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 2. Brace a change of direction longer than 12 feet (3.7 m).
- 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 an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.
- 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.

3.06 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.08 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. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent 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. Prepare test and inspection reports.

3.09 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 6. Provide drainage and cleanup for wash-down procedures.
 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior or stainless steel.
- B. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
 - a. Pressure Class: Positive 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

- a. Pressure Class: Positive 4-inch wg (1000 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
4. Ducts Connected to Equipment Not Listed Above:
- a. Pressure Class: Positive 4-inch wg (1000 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
- a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Air-Handling Units:
- a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
3. Ducts Connected to Equipment Not Listed Above:
- a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. 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 3-inch wg (750 Pa).
 - 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 Air-Handling Units:
- a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - 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.
3. Ducts Connected to Equipment Not Listed Above:

- a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
 - 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. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- F. Intermediate Reinforcement:
- 1. Galvanized-Steel Ducts: Galvanized steel, Carbon steel coated with zinc-chromate primer or Galvanized steel or carbon steel coated with zinc-chromate primer.
 - 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized or Match duct material.
 - 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized or Match duct material.
 - 4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.
- G. Liner:
- 1. Supply Air Ducts: Flexible elastomeric, 2 inches (51 mm) thick.
 - 2. Return Air Ducts: Flexible elastomeric, 2 inches (51 mm) thick.
 - 3. Supply Fan Plenums: Flexible elastomeric, 2 inches (51 mm) thick.
 - 4. Return- and Exhaust-Fan Plenums: Flexible elastomeric, 2 inches (51 mm) thick.
 - 5. Transfer Ducts: Flexible elastomeric, 2 inches (51 mm) thick.
- H. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 2 inches (51 mm) thick.
 2. Return Air Ducts: 2 inches (51 mm) thick.
 3. Exhaust Air Ducts: 1 inch (25 mm) thick.
- I. 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 (5 m/s) 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 (5 to 7.6 m/s):
 - 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 (7.6 m/s) 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 (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

- 3) Velocity 1500 fpm (7.6 m/s) 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 (305 mm) and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam or Welded.
- J. 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 (5 m/s) or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00
DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Manual-volume dampers.
 - 3. Turning vanes.
 - 4. Flexible ducts.
 - 5. Flexible connectors.
 - 6. Duct accessory hardware.

1.02 SUBMITTALS

- A. Product Data: For the following:
 - 1. Backdraft dampers.
 - 2. Manual-volume dampers.
 - 3. Duct-mounted access doors and panels.
 - 4. Flexible ducts.
 - 5. Turning vanes.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
 - 1. Special fittings and manual- and automatic-volume-damper installations.
 - 2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.03 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.04 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.01 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Stainless Steel: ASTM A 480/ A 480M
- C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 BACKDRAFT DAMPERS

- A. Description: Suitable for horizontal or vertical installations.
- B. Frame: 0.052-inch- thick, galvanized, sheet steel, with welded corners and mounting flange.
- C. Blades: 0.050-inch- thick aluminum sheet.
- D. Blade Seals: Neoprene.
- E. Blade Axles: Galvanized steel.
- F. Tie Bars and Brackets: Galvanized steel.
- G. Return Spring: Adjustable tension.

2.03 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized, sheet steel.
 - 3. Blade Seals: Neoprene.
 - 4. Blade Axles: Galvanized steel.
 - 5. Tie Bars and Brackets: Galvanized steel.
- C. Jackshaft: 1-inch- diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

- D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.04 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- wide, double radius curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.
- C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.05 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet.
- C. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- D. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- E. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - 1. Minimum Weight: 24 oz./sq. yd.
 - 2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.
- F. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd.
 - 2. Tensile Strength: 450 lbf/inch in the warp, and 340 lbf/inch in the filling.

2.06 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing, glass-fiber insulation around a continuous inner liner. Duct insulation shall have an R value of 8.
 - 1. Reinforcement: Steel-wire helix encapsulated in inner liner.
 - 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.

- 3. Inner Liner: Polyethylene film.
- C. Pressure Rating: 6-inch wg positive, 1/2-inch wg negative.

2.07 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 length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install turning vanes in 90° rectangular elbows.
- E. Install flexible connectors in ducts associated with fans and motorized equipment supported by vibration isolators.

3.02 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION

SECTION 23 34 16
CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: For each product.
 - 1. Airfoil centrifugal fans.
 - 2. Backward-inclined centrifugal fans.
 - 3. Forward-curved centrifugal fans.
 - 4. Plenum fans.
 - 5. Plug fans.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include rated capacities, furnished specialties, and accessories for each fan.
 - 2. Certified fan performance curves with system operating conditions indicated.
 - 3. Certified fan sound-power ratings.
 - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5. Material thickness and finishes, including color charts.
 - 6. Dampers, including housings, linkages, and operators.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 5. 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.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- B. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AMCA Compliance:
 - 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
 - 2. Operating Limits: Classify according to AMCA 99.
- 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. Characteristics:
 - 1. Class: I .
 - 2. Housing Material: Reinforced steel, Aluminum or Stainless steel.
 - 3. Special Housing Coating: Thermoplastic vinyl Epoxy or Powder-baked enamel.
 - 4. Wheel Material: Steel, Aluminum or Stainless steel.
 - 5. Special Wheel Coating: Thermoplastic vinyl, Epoxy or Powder-baked enamel.
 - 6. Drive Type: Belt or Direct.
 - 7. Motor:
 - a. Motor Enclosure: Totally enclosed, fan cooled.
 - b. Enclosure Materials: Cast iron, Cast aluminum or Rolled steel.
 - c. Efficiency: Premium efficient.
 - 8. Vibration Isolators: Restrained spring isolators having a static deflection of 1 inch (25 mm).
 - 9. Spark-Resistance Class: C.

2.02 AIRFOIL CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Acme Engineering & Mfg. Corp.
 - 2. Greenheck Fans
 - 3. Loren Cook Company.
 - 4. New York Blower Company (The).
 - 5. Twin City Fans.
- B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 3. Factory-installed and -wired disconnect switch.
- C. Housings:
1. Formed panels to make curved-scroll housings with shaped cutoff.
 2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 3. Horizontally split, bolted-flange housing.
 4. Spun inlet cone with flange.
 5. Outlet flange.
- D. Airfoil Wheels:
1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange.
 2. Heavy backplate.
 3. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
 4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- E. Shafts:
1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- F. Prelubricated and Sealed Shaft Bearings:
1. Self-aligning, pillow-block-type bearings.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hour .
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000.
- G. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- H. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.

3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- I. Belt Drives:
1. Factory mounted, with adjustable alignment and belt tensioning.
 2. Service Factor Based on Fan Motor Size: 1.5.
 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 7. Motor Mount: Adjustable for belt tensioning.
- J. Accessories:
1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 2. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
 3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
 6. Inlet Screens: Grid screen of same material as housing.
 7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 8. Spark-Resistant Construction: AMCA 99.
 9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
 10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.03 BACKWARD-INCLINED CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
1. Acme Engineering & Mfg. Corp.
 2. Twin City Fans.
 3. Greenheck Fans.
 4. Loren Cook Company.

5. New York Blower Company (The).
- B. Description:
1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 3. Factory-installed and -wired disconnect switch.
- C. Housings:
1. Formed panels to make curved-scroll housings with shaped cutoff.
 2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 3. Horizontally split, bolted-flange housing.
 4. Spun inlet cone with flange.
 5. Outlet flange.
- D. Backward-Inclined Wheels:
1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
 2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.
- E. Shafts:
1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- F. Prelubricated and Sealed Shaft Bearings:
1. Self-aligning, pillow-block-type ball bearings.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- G. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- H. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.

3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- I. Belt Drives:
1. Factory mounted, with adjustable alignment and belt tensioning.
 2. Service Factor Based on Fan Motor Size: 1.5.
 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 7. Motor Mount: Adjustable for belt tensioning.
- J. Accessories:
1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 2. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
 3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
 6. Inlet Screens: Grid screen of same material as housing.
 7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 8. Spark-Resistant Construction: AMCA 99.
 9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
 10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.04 FORWARD-CURVED CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
1. Acme Engineering & Mfg. Corp.
 2. Central Blower Company.
 3. Greenheck Fans.
 4. New York Blower Company (The).

5. Twin City Fans.
- B. Description:
1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 3. Factory-installed and -wired disconnect switch.
- C. Housings:
1. Formed panels to make curved-scroll housings with shaped cutoff.
 2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 3. Horizontally split, bolted-flange housing.
 4. Spun inlet cone with flange.
 5. Outlet flange.
- D. Forward-Curved Wheels:
1. Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.
 2. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.
- E. Shafts:
1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- F. Prelubricated and Sealed Shaft Bearings:
1. Self-aligning, pillow-block-type ball bearings.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- G. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- H. Grease-Lubricated Shaft Bearings:
1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.

3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.

I. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

J. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.05 PLENUM FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
1. Twin City Fans.
 2. Greenheck Fans.
 3. Loren Cook Company.
 4. New York Blower Company (The).

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Airfoil Wheels:

1. Single-width-single-inlet construction with smooth-curved inlet flange.
2. Heavy backplate.
3. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

D. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum-rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

E. Prelubricated and Sealed Shaft Bearings:

1. Self-aligning, pillow-block-type ball bearings.
2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.

F. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.

G. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.

H. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 7. Motor Mount: Adjustable for belt tensioning.
- I. Accessories:
1. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 2. Spark-Resistant Construction: AMCA 99.
 3. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.06 PLUG FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
1. Twin City Fans.
 2. Greenheck Fans.
 3. Loren Cook Company.
 4. New York Blower Company (The).
- B. Description:
1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 3. Factory-installed and -wired disconnect switch.
- C. Airfoil Wheels:
1. Single-width-single-inlet construction with smooth-curved inlet flange.
 2. Heavy backplate.
 3. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
 4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- D. Shafts:
1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

- E. Prelubricated and Sealed Shaft Bearings:
 1. Self-aligning, pillow-block-type ball bearings.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- F. Grease-Lubricated Shaft Bearings:
 1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- G. Grease-Lubricated Shaft Bearings:
 1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 2. Ball-Bearing Rating Life: ABMA 9, L10 at 120,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L10 at 120,000 hours.
- H. Belt Drives:
 1. Factory mounted, with adjustable alignment and belt tensioning.
 2. Service Factor Based on Fan Motor Size: 1.5.
 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 7. Motor Mount: Adjustable for belt tensioning.
- I. Accessories:
 1. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 2. Spark-Resistant Construction: AMCA 99.
 3. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.07 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.08 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/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Install centrifugal fans on cast-in-place concrete equipment base(s).
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Curb Support: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
- F. Unit Support: Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction.
- G. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration isolation and seismic-control devices.
 - 1. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.
 - 2. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation and seismic-control devices.
- H. Install units with clearances for service and maintenance.
- I. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 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. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 - 10. Remove and replace malfunctioning units and retest as specified above.
- D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.04 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Centrifugal Roof Ventilators
 - 2. In-line Centrifugal Fans

1.02 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For unit hangers and supports 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
- D. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.

- 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- E. Field quality-control reports.
- F. 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, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.05 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.06 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - 1. Loren Cook Company.
 - 2. Twin City Fan.
 - 3. Greenheck Fan Cooperation

2.02 CENTRIFUGAL ROOF VENTILATORS

- A. Housing: Removable, spun-aluminum, dome top and outlet baffle, one-piece, aluminum base with venturi inlet cone.
 - 1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- C. Belt Drives:

1. Resiliently mounted to housing.
 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 5. Fan and motor isolated from exhaust airstream.
- D. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Built-in cant and mounting flange.
 2. Overall Height: 8 inches (200 mm).
 3. Pitch Mounting: Manufacture curb for roof slope.
 4. Metal Liner: Galvanized steel.

2.03 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 1. Loren Cook Company.
 2. Twin City Fan.
 3. Greenheck Fan Cooperation
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- E. 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.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- G. 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: 1/2- by 1-inch 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.

2.04 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 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 specified in Division 26 Sections.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.05 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
- C. Install roof-mounted units to curbs with cadmium-plated hardware.
- D. Install units with clearances for service and maintenance.
- E. 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 tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in 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.
 - 2. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for balancing diffusers, registers, and grilles.

1.02 DEFINITIONS

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

1.03 SUBMITTALS

- A. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
- B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.04 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Diffusers, registers, and grilles are scheduled at the end of this Section.

2.02 SOURCE QUALITY CONTROL

- A. Testing: Test performance 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. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- 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 the panel. Where architectural features or other items conflict with installation, notify Engineer for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connection 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.

3.04 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.05 DIFFUSER, REGISTER AND GRILLE SCHEDULE

- A. Lay in Ceiling Diffuser:
 - 1. Products: Subject to compliance with requirements, modular removable core, 4 core, provide one of the following:
 - a. Tuttle and Bailey.
 - b. Anemostat Products; Dynamics Corp. of America.
 - c. Titus.

2. Material: Steel.
 3. Finish: Baked enamel, white.
 4. Duct Connection: Round. or Square.
 5. Duct Connection Size: As shown on drawings.
 6. Face Size: 24" x 24."
 7. Maximum Noise-Criterion Rating: NC20.
 8. Face Style: Square. Perforated.
 9. Mounting: Lay in.
 10. Pattern: Adjustable.
 11. Dampers: Opposed blade.
- B. Hard Ceiling or Duct Mount Diffusers: Is the same as lay in ceiling diffusers except:
1. Face Size: Frame size required for duct connection size.
 2. Face Style: Square.
 3. Mounting: Surface mount.
 4. Accessories: Provide fames style to match mounting style.
- C. Layin ceiling return or exhaust register is same as lay in ceiling diffuser except without adjustable pattern and removable core.

END OF SECTION

SECTION 23 51 23
GAS VENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Listed double-wall vents.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.
- B. Shop Drawings: For vents.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Detail fabrication and assembly of hangers and seismic restraints.

1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Sample Warranty: For special warranty.

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 D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.
- B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.01 LISTED TYPE B AND BW VENTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Selkirk Corporation.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F (248 deg C) continuously for Type B; with neutral or negative flue pressure complying with NFPA 211.

- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) airspace.
- D. Inner Shell: ASTM A 666, Type 430 stainless steel.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATION

- A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.03 INSTALLATION OF LISTED VENTS

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."
- B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- E. Lap joints in direction of flow.

3.04 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION

SECTION 23 73 13
MODULAR OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Constant-air-volume, single-zone air-handling units.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.
- C. Seismic Performance: Air-handling units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.03 ACTION SUBMITTALS

- A. Product Data: For each air-handling unit indicated.
1. Unit dimensions and weight.
 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
 4. Certified coil-performance ratings with system operating conditions indicated.
 5. Dampers, including housings, linkages, and operators.
 6. Filters with performance characteristics.
- B. Delegated-Design Submittal: For vibration isolation and seismic restraints 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
 2. Support location, type, and weight.
 3. Field measurements.
- B. Seismic Qualification Certificates: For air-handling units, 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. Source quality-control reports.
- D. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

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. Filters: One set(s) for each air-handling unit.
 2. Gaskets: One set(s) for each access door.
 3. Fan Belts: One set(s) for each air-handling unit fan.

1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. Comply with NFPA 70.

1.08 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Daikin Applied
 - 2. Huntair
 - 3. Energy Labs
 - 4. Haakon

2.02 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
 - 1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 - 2. Casing Joints: Sheet metal screws or pop rivets.
 - 3. Sealing: Seal all joints with water-resistant sealant.
 - 4. Factory Finish for Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 5. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.
 - 6. Casing Coating: Hot-dip galvanized or Powder-baked enamel.
 - 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Casing Insulation and Adhesive:
 - 1. Materials: ASTM C 1071, Type I.
 - 2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the cooling-coil section.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

- c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service-air velocity.
 - 3. Location and Application: Encased between outside and inside casing.
- C. Inspection and Access Panels and Access Doors:
 - 1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
 - 2. Inspection and Access Panels:
 - a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - 3. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Fabricate windows in doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
 - d. Size: At least 18 inches (450 mm) wide by full height of unit casing up to a maximum height of 60 inches (1500 mm).
 - 4. Locations and Applications:
 - a. Fan Section: Doors and inspection and access panels.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection and access panel.
 - d. Damper Section: Doors.
 - e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - f. Mixing Section: Doors.
 - g. Humidifier Section: Doors.
 - 5. Service Light: 100-W vaporproof fixture with switched junction box located inside adjacent to door.
 - a. Locations: Each section accessed with door.
- D. Condensate Drain Pans:
 - 1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
 - a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

- b. Depth: A minimum of 2 inches (50 mm) deep.
 - 2. Formed sections or Integral part of floor plating.
 - 3. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
 - 4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
 - a. Minimum Connection Size: NPS 2 (DN 50).
 - 5. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - 6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
- E. Service Platform: Galvanized steel or Aluminum, 42 inches (1070 mm) wide running entire length of unit and located on service access side, with angle side rails, 4-inch (100-mm) kick plates, and expanded metal floor. Provide platform with a fixed ladder that extends from the top of the side rail to the floor.
- F. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
- 1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 23 05 48 "Vibration and Seismic Controls for HVAC" when air-handling unit frame is anchored to building structure.

2.03 FAN, DRIVE, AND MOTOR SECTION

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- 1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
- 1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 2. Horizontal-Flanged, Split Housing: Bolted construction.
 - 3. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.
 - 4. Flexible Connector: Factory fabricated with a fabric strip 5-3/4 inches (146 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized-steel sheet or 0.032-inch- (0.8-mm-) thick aluminum sheets; select metal compatible with casing.

- a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
 - 1) Fabric Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2) Fabric Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - 3) Fabric Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- C. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.
- D. Backward-Inclined, Centrifugal Fan Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- E. Airfoil, Centrifugal Fan Wheels: Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- F. Fan Shaft Bearings:
 - 1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 120,000 hours according to ABMA 9.
 - 2. Grease-Lubricated, Tapered-Roller Bearings: Self-aligning, pillow-block type with double-locking collars and 2-piece, cast-iron housing and a rated life of 120,000 hours according to ABMA 11.
 - 3. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
- G. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.
 - 1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - 2. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 3. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.
 - 4. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.1046-inch- (2.7-mm-) thick, 3/4-inch (20-mm) diamond-mesh wire screen, welded to steel angle frame; prime coated.
- H. Discharge Dampers: Heavy-duty steel assembly with channel frame and sealed ball bearings, and opposed blades constructed of two plates formed around and welded to shaft, with blades linked out of air stream to single control lever.
- I. Internal Vibration Isolation and Seismic Control: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 2 inches (50 mm).
 - 1. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section

components with reinforcement strong enough to withstand seismic forces defined in Section 23 05 48 "Vibration and Seismic Controls for HVAC" when fan-mounting frame and air-handling-unit mounting frame are anchored to building structure.

- J. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - 1. Enclosure Type: Totally enclosed, fan cooled.
 - 2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - 3. 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.
 - 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - 5. Mount unit-mounted disconnect switches on exterior or interior of unit.
- K. Variable Frequency Controllers:
 - 1. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
 - 2. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
 - 3. Unit Operating Requirements:
 - a. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.
 - b. Input frequency tolerance of 06/11 Hz, plus or minus 6 percent.
 - c. Minimum Efficiency: 96 percent at 60 Hz, full load.
 - d. Minimum Displacement Primary-Side Power Factor: 96 percent.
 - e. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 - f. Starting Torque: 100 percent of rated torque or as indicated.
 - g. Speed Regulation: Plus or minus 1 percent.
 - 4. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
 - 5. Internal Adjustability Capabilities:
 - a. Minimum Speed: 5 to 25 percent of maximum rpm.
 - b. Maximum Speed: 80 to 100 percent of maximum rpm.
 - c. Acceleration: 2 to a minimum of 22 seconds.
 - d. Deceleration: 2 to a minimum of 22 seconds.
 - e. Current Limit: 50 to a minimum of 110 percent of maximum rating.
 - 6. Self-Protection and Reliability Features:
 - a. Input transient protection by means of surge suppressors.
 - b. Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.

- c. Adjustable motor overload relays capable of NEMA ICS 2, Class 30 performance.
 - d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - e. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - f. Loss-of-phase protection.
 - g. Reverse-phase protection.
 - h. Short-circuit protection.
 - i. Motor overtemperature fault.
7. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
 8. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
 9. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
 10. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
 11. Door-mounted LED status lights shall indicate the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.
 - d. Line fault.
 - e. Overcurrent.
 - f. External fault.
 12. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual-speed-control potentiometer and elapsed time meter.
 13. Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
 - a. Output frequency (Hertz).
 - b. Motor speed (rpm).
 - c. Motor status (running, stop, fault).
 - d. Motor current (amperes).
 - e. Motor torque (percent).
 - f. Fault or alarming status (code).
 - g. Proportional-integral-derivative (PID) feedback signal (percent).
 - h. DC-link voltage (volts direct current).

- i. Set-point frequency (Hertz).
 - j. Motor output voltage (volts).
14. Control Signal Interface:
- a. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
 - b. Remote signal inputs capable of accepting any of the following speed-setting input signals from the control system:
 - 1) 0 to 10-V dc.
 - 2) 0-20 or 4-20 mA.
 - 3) Potentiometer using up/down digital inputs.
 - 4) Fixed frequencies using digital inputs.
 - 5) RS485.
 - 6) Keypad display for local hand operation.
 - c. Output signal interface with a minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hertz).
 - 2) Output current (load).
 - 3) DC-link voltage (volts direct current).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hertz).
 - d. Remote indication interface with a minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - 1) Motor running.
 - 2) Set-point speed reached.
 - 3) Fault and warning indication (overtemperature or overcurrent).
 - 4) High- or low-speed limits reached.
15. Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.
16. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.
17. Accessories:
- a. Devices shall be factory installed in controller enclosure unless otherwise indicated.
 - b. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
 - c. Standard Displays:

- 1) Output frequency (Hertz).
- 2) Set-point frequency (Hertz).
- 3) Motor current (amperes).
- 4) DC-link voltage (volts direct current).
- 5) Motor torque (percent).
- 6) Motor speed (rpm).
- 7) Motor output voltage (volts).

2.04 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.
5. Seismic Fabrication Requirements: Fabricate coil section, internal mounting frame and attachment to coils, and other coil section components with reinforcement strong enough to withstand seismic forces defined in Section 23 05 48 "Vibration and Seismic Controls for HVAC" when coil-mounting frame and air-handling-unit mounting frame are anchored to building structure.

2.05 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Disposable Panel Filters:

1. Factory-fabricated, viscous-coated, flat-panel type.
2. Thickness: 2 inches (50 mm).
3. Arrestance (ASHRAE 52.1): 80.
4. Merv (ASHRAE 52.2): 5.
5. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
6. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

C. Activated-Carbon Filters:

1. Factory-fabricated unit in deep-V arrangement with disposable panel prefilter.

2. Media: Activated carbon mounted in removable carbon-cell trays of epoxy-coated steel.
 3. Activated-Carbon Capacity: 12 lb (5.4 kg) of activated carbon per 500 cfm (236 L/s) of airflow.
 4. Housing: 0.064-inch- (1.6-mm-) thick, galvanized steel, for side servicing through gasketed access doors on both sides. Equip housings with metal slide channel tracks to hold activated-carbon trays.
- D. Filter Gage:
1. 3-1/2-inch- (90-mm-) diameter, diaphragm-actuated dial in metal case.
 2. Vent valves.
 3. Black figures on white background.
 4. Front recalibration adjustment.
 5. 2 percent of full-scale accuracy.
 6. Range: 0- to 2.0-inch wg (0 to 500 Pa).
 7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch (6-mm) aluminum tubing, and 2- or 3-way vent valves.

2.06 DAMPERS

- A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm (10-m/s) face velocity through damper and 4-inch wg (1000-Pa) pressure differential.
- B. Damper Operators: Comply with requirements in Section 23 09 00 "Instrumentation and Control for HVAC."
- C. Electronic Damper Operators:
 1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
 3. Operator Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
 5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

6. Size dampers for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
 - e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
7. Coupling: V-bolt and V-shaped, toothed cradle.
8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
10. Power Requirements (Two-Position Spring Return): 24-V ac.
11. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
12. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
13. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
14. Run Time: 12 seconds open, 5 seconds closed.
- D. Outdoor- and Return-Air Mixing Dampers: Parallel-blade, galvanized-steel or extruded-aluminum dampers mechanically fastened to cadmium-plated steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
- E. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel and extruded-aluminum dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with cadmium-plated steel operating rods rotating in stainless-steel sleeve or sintered bronze or nylon bearings mounted in a single galvanized-steel or extruded-aluminum frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. (0.22 L/s per sq. m) at 1-inch wg (250 Pa) and 9 cfm/sq. ft. (0.4 L/s per sq. m) at 4-inch wg (1.0 MPa).
- F. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.
- G. Combination Filter and Mixing Section:
 1. Cabinet support members shall hold 2-inch- (50-mm-) thick, pleated, flat, permanent or throwaway filters.
 2. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.

2.07 CAPACITIES AND CHARACTERISTICS

A. Casing:

1. Outside Casing: Galvanized steel, minimum 0.079 inch (2.0 mm) thick.
2. Outside Casing: Stainless steel, minimum 0.0781 inch (2.0 mm) thick.
3. Inside Casing: Galvanized steel, solid, minimum 0.079 inch (2.0 mm) thick.
4. Inside Casing: Stainless steel, solid, minimum 0.0781 inch (2.0 mm) thick.
5. Floor Plate: Galvanized steel, minimum 0.079 inch (2.0 mm) thick.
6. Floor Plate: Stainless steel, minimum 0.0781 inch (2.0 mm) thick.
7. Insulation Thickness: 2 inches (50 mm).
8. Static-Pressure Classifications for Unit Sections before Fans: 6-inch wg (1500 Pa).
9. Static-Pressure Classifications for Unit Sections after Fans: 6-inch wg (1500 Pa).

B. Supply Fan:

1. Class I: AMCA 99-2408.
2. Drive: Direct.
3. Type: Steel, backward-inclined centrifugal or Steel, airfoil centrifugal.
4. Fan Housing and Wheel Coating: Hot-dip galvanized or Powder-baked enamel.

C. Return Fan:

1. Class I: AMCA 99-2408.
2. Drive: Direct.
3. Type: Steel, backward-inclined centrifugal or Steel, airfoil centrifugal.
4. Fan Housing and Wheel Coating: Hot-dip galvanized or Powder-baked enamel.

D. Heating Coil:

1. Coil Type: Continuous circuit.
2. Piping Connections: Threaded, Flanged, same end and opposite ends of coil.
3. Tube Material: Copper.
4. Fin Type: Plate or Spiral.
5. Fin Material: Aluminum or Copper.
6. Fin and Tube Joint: Mechanical bond or Silver brazed.
7. Headers:
 - a. Seamless copper tube with brazed joints, prime coated.
 - b. Fabricated steel, with brazed joints, prime coated.
 - c. Provide insulated cover to conceal headers exposed outside casings.
8. Frames: Channel frame, 0.0625-inch (- 1.58-mm-) thick stainless steel.
9. Coil Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
10. Coating: Powder-baked enamel.
11. Integral Face-and-Bypass Dampers: Horizontal or Vertical, opposed-blade, galvanized-steel or extruded-aluminum dampers with cadmium-plated steel operating rods rotating

in sintered bronze or nylon bearings mounted in a single galvanized-steel or extruded-aluminum frame, with operating rods connected with a common linkage. Meeting edges of blades shall have gaskets and edge seals, and blades shall be mechanically fastened.

E. Cooling Coil:

1. Coil Type: Continuous circuit.
2. Piping Connections: Flanged, same end and opposite ends of coil.
3. Tube Material: Copper.
4. Fin Type: Plate or Spiral.
5. Fin Material: Aluminum or Copper.
6. Fin and Tube Joint: Mechanical bond or Silver brazed.
7. Headers:
 - a. Cast iron with cleaning plugs and drain and air vent tappings.
 - b. Seamless copper tube with brazed joints, prime coated.
 - c. Fabricated steel, with brazed joints, prime coated.
 - d. Provide insulated cover to conceal headers exposed outside casings.
8. Frames: Channel frame, 0.0625-inch (- 1.58-mm-) thick galvanized steel or 0.0625-inch (- 1.58-mm-) thick stainless steel.
9. Coil Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
10. Coating: Hot-dip galvanized or Powder-baked enamel.

F. Prefilters:

1. Access Location: Front, Back or Side.

G. Filters:

1. Access Location: Front, Back or Side.

H. Dampers: Zone or Mixing dampers.

2.08 SOURCE QUALITY CONTROL

- A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
- B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
- C. Water Coils: Factory tested to 300 psig (2070 kPa) according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.01 EXAMINATION

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

- B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Equipment Mounting:
 1. Install air-handling units on cast-in-place concrete equipment bases.
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 3. Comply with requirements for vibration isolation devices specified in Section 23 05 48.13 "Vibration Controls for HVAC."
- B. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.
- D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.03 CONNECTIONS

- A. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air-handling unit to allow service and maintenance.
- C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using NPS 1-1/4 (DN 32), ASTM B 88, Type M (ASTM B 88M, Type C) copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 23 21 13 "Hydronic Piping" and Section 23 21 16 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- F. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 23 33 00 "Air Duct Accessories."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
1. Leak Test: After installation, fill coils with water, and test coils and connections for leaks.
 2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 3. HEPA-Filter Operational Test: Pressurize housing to a minimum of 3-inch wg (750 Pa) or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Verify that shipping, blocking, and bracing are removed.
 3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
 6. Verify that zone dampers fully open and close for each zone.
 7. Verify that face-and-bypass dampers provide full face flow.
 8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
 9. Comb coil fins for parallel orientation.
 10. Verify that proper thermal-overload protection is installed for electric coils.
 11. Install new, clean filters.
 12. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.06 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.07 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION

SECTION 23 74 16.11
PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components and accessories:
 - 1. Casings.
 - 2. Fans.
 - 3. Motors.
 - 4. Coils.
 - 5. Refrigerant circuit components.
 - 6. Air filtration.
 - 7. Gas furnaces.
 - 8. Dampers.
 - 9. Electrical power connections.
 - 10. Controls, in coordination with Section 23 09 23 "Direct Digital Controls (HVAC)
 - 11. Roof curbs.

1.02 DEFINITIONS

- A. DDC: Direct digital controls.
- B. ECM: Electronically commutated motor.
- C. MERV: Minimum efficiency reporting value.
- D. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.03 ACTION SUBMITTALS

- A. Product Data: For each RTU.
 - 1. Include manufacturer's technical data.

2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For RTU supports 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. Include design calculations for selecting vibration isolators and seismic restraints for designing vibration isolation bases.
 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 3. Seismic Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Structural members to which RTUs will be attached.
 2. Roof openings.
 3. Roof curbs and flashing.
- B. Seismic Qualification Certificates: For RTUs, 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.
 4. Restraint of internal components, including fans, coils, and refrigeration components.
- C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control reports.

- E. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

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. Fan Belts: One set(s) for each belt-driven fan.
 - 2. Filters: One set(s) of filters for each unit.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than 5 years from date of Substantial Completion.
 - 2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
 - 3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than 1 year from date of Substantial Completion.
 - 4. Warranty Period for Control Boards: Manufacturer's standard, but not less than 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DESCRIPTION

- A. AHRI Compliance:
 - 1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
 - 3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
 - 4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.
- B. AMCA Compliance:
 - 1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
 - 2. Damper leakage tested according to AMCA 500-D.
 - 3. Operating Limits: Classify according to AMCA 99.
- C. ASHRAE Compliance:
 - 1. Comply with ASHRAE 15 for refrigeration system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

- D. ASHRAE/IES Compliance: Comply with applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.
- F. UL Compliance: Comply with UL 1995.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to jurisdictions having authority, and marked for intended location and application.

2.02 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from one of the following:
 - 1. Carrier Corporation, a unit of United Technologies Corp.
 - 2. Trane.
 - 3. YORK, a Johnson Controls Company.

2.03 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Performance:
 - 1. Basic Wind Speed: 115 MPH, Exposure C
 - 2. Building Classification Category: III.
 - 3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal service level wind pressure.
- B. Seismic Performance: RTUs, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified.
- D. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 01 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.
 - 1. Design RTU supports to comply with seismic performance requirements.
- E. Base Rail Thickness: 16 gauge.
- F. Supply-Air Fan:
 - 1. Fan Type: Belt driven, double width, forward curved, centrifugal.
 - 2. Fan Type: Double width, forward curved, centrifugal.
 - 3. Motor Enclosure Type: ODP
- G. Dampers:
 - 1. Outdoor- and Return-Air Mixing Dampers: parallel blade galvanized-steel ultra low leakage dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with gears and interconnect so dampers operate simultaneously.
 - 2. Barometric relief dampers.

- H. Vibration Isolation Devices: Isolation curb, with 2" minimum deflection if required per schedule notes.

2.04 CASINGS

- A. General Fabrication Requirements for Casings: Formed galvanized steel
- B. Single-Wall Construction:
- C. Exterior Casing Material: Galvanized steel with factory-painted finish
 - 1. Corrosion Protection: 500 hours' salt spray test according to ASTM B 117.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1. Materials: ASTM C 1071, Type I.
 - 2. Thickness: ½"
 - 3. Liner materials shall have airstream surface coated with foil facing.
 - 4. Liner Adhesive: Comply with ASTM C 916, Type I.
- E. Plastic Condensate Drain Pans: Fabricated using rigid heavy plastic polymer, a minimum of 1" deep, and complying with ASHRAE 62.1 for design and construction of drain pans.
 - 1. Drain Connections: Threaded nipple.
- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.05 FANS

- A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
 - 1. Belt-Driven Supply-Air Fans: Provide with factory mounted VFD. VFD shall be installed inside the unit cabinet, mounted, wired and tested.
- B. Condenser-Coil Fan: Variable speed propeller, mounted on shaft of permanently lubricated ECM motors.

2.06 MOTORS

- A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Duty: Continuous duty at ambient temperature of 104 deg F (40 deg C) and at altitude of 3300 feet (1000 m) above sea level.
- C. 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.
- D. Efficiency: Energy efficient, as defined in section 313 of EISA 2007.
- E. Bearings: Permanently lubricated.
 - 1. Thermal Protection: inherent automatic- reset thermal overload protection or circuit breaker

2.07 COILS

- A. Coil Coating: E-coat condenser coil.

- B. Supply-Air Refrigerant Coil:
 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
 2. Polymer strip shall prevent all copper coils from contacting steel coil frame or condensate pan.
- C. Outdoor-Air Refrigerant Coil:
 1. Aluminum-plate fin and seamless copper tube in steel casing. Retain subparagraph below to require copper-plate fin coils.
 2. Polymer strip shall prevent all copper coils from contacting steel coil frame or condensate pan.

2.08 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief and crankcase heater.
- B. Refrigeration Specialties:
 1. Refrigerant: R-410A.
 2. Expansion valve with replaceable thermostatic element.
 3. Refrigerant filter/dryer.
 4. Manual-reset high-pressure safety switch.
 5. Automatic-reset low-pressure safety switch.
 6. Minimum off-time relay.
 7. Automatic-reset compressor motor thermal overload.

2.09 AIR FILTRATION

- A. Shall consist of factory- installed, low velocity, disposable 2- in. thick fiberglass filters of commercially available sizes. Unit shall use only one filter size. Multiple sizes are not acceptable.

2.10 GAS FURNACE

- A. Burners: Aluminum coated steel.
 1. Fuel: Natural gas.
 2. Ignition: Electronically controlled electric spark.
- B. Heat-Exchanger: Aluminum coated steel. Stainless steel for units under 65,000 MBH.
- C. Power Vent: Integral, motorized.
- D. Gas Valve Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.11 DAMPERS

- A. Leakage Rate: Comply with ASHRAE/IES 90.1.
- B. Damper Motor: Modulating with adjustable minimum position.

2.12 ELECTRICAL POWER CONNECTIONS

- A. RTU shall have a single connection of power to unit with control-circuit transformer with built-in overcurrent protection.

2.13 CONTROLS

- A. Basic Unit Controls:
 - 1. Control-voltage transformer.
 - a. Defrost Control for Condenser Coil: Timer to initiate defrost sequence. (Heat Pump only)

2.14 ACCESSORIES

- A. Hail guards of galvanized steel, painted to match casing.

2.15 ROOF CURBS

- A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

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 RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 07 72 00 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- B. Unit Support: Install unit level on structural steel supports. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Equipment Mounting:
 - 1. 03 30 00"Cast-in-PlaceConcrete."][Section033053"MiscellaneousCast-in-PlaceConcrete."]
 - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.03 CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 23 33 00 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.
 - 5. Install staggered layers of rigid foam inside roof curb, 4 inches thick. Cover with 2 layers of drywall with staggered taped and sealed joints.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest indirect waste.
 - a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.
- C. Connect condensate drain pans with condensate drain piping: ASTM B 88, Type M (ASTM B 88M, Type C), drawn-temper copper tubing, wrought-copper fittings, and soldered joints. Extend to nearest indirect drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- D. Where installing piping adjacent to RTUs, allow space for service and maintenance.
 - 1. Gas Piping: Comply with applicable requirements in Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. RTU will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to furnace combustion chamber.
4. Inspect for visible damage to compressor, coils, and fans.
5. Inspect internal insulation.
6. Verify that labels are clearly visible.
7. Verify that clearances have been provided for servicing.
8. Verify that controls are connected and operable.
9. Verify that filters are installed.
10. Clean condenser coil and inspect for construction debris.
11. Clean furnace flue and inspect for construction debris.
12. Connect and purge gas line.
13. Remove packing from vibration isolators.
14. Inspect operation of barometric relief dampers.
15. Verify lubrication on fan and motor bearings.
16. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
17. Adjust fan belts to proper alignment and tension.
18. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
19. Inspect and record performance of interlocks and protective devices; verify sequences.
20. Operate unit for an initial period as recommended or required by manufacturer.
21. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
22. Calibrate thermostats.
23. Adjust and inspect high-temperature limits.
24. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.

25. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
26. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
27. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
28. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
29. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.
30. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.06 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

SECTION 23 81 26
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units 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 protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) for each air-handling unit.
 - 2. Gaskets: One set(s) for each access door.
 - 3. Fan Belts: One set(s) for each air-handling unit fan.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.07 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: One year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
 2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
 3. Daikin
 4. Liebert

2.02 INDOOR UNITS (5 TONS OR LESS)

- A. Concealed Evaporator-Fan Components:
 1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 2. Insulation: Faced, glass-fiber duct liner.
 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
 5. Fan Motors:

- a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - b. Multi-Tapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: Permanent, cleanable.
8. Condensate Drain Pans:
- a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
 - 1) Minimum Connection Size: NPS 3/4.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
- B. Wall-Mounted, Evaporator-Fan Components:
- 1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
 - 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 - 3. Fan: Direct drive, centrifugal.
 - 4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - f. Mount unit-mounted disconnect switches on exterior of unit.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
 - a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.
 - b. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
 - 1) Minimum Connection Size: NPS 1
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
7. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch or 2 inches.
 - 3) Arrestance according to ASHRAE 52.1: 80.
 - 4) Merv according to ASHRAE 52.2: 5.
 - 5) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - 6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.
 - c. Extended-Surface, Disposable Panel Filters:
 - 1) Factory-fabricated, dry, extended-surface type.
 - 2) Thickness: 1 inch or 2 inches.
 - 3) Arrestance according to ASHRAE 52.1: 90.
 - 4) Merv according to ASHRAE 52.2: 7.
 - 5) Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
 - 6) Media-Grid Frame: Nonflammable cardboard, Galvanized steel or Fire-retardant, 3/4-inch particleboard with gaskets.

- 7) Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

2.03 OUTDOOR UNITS (5 TONS OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
 4. Fan: Aluminum-propeller type, directly connected to motor.
 5. Motor: Permanently lubricated, with integral thermal-overload protection.
 6. Low Ambient Kit: Permits operation down to 35 deg F.
 7. Mounting Base: Polyethylene.

2.04 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 23 09 00 "Instrumentation and Control for HVAC."
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 1. Compressor time delay.
 2. 24-hour time control of system stop and start.
 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 4. Fan-speed selection including auto setting.
- D. Automatic-reset timer to prevent rapid cycling of compressor.
- E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- F. Drain Hose: For condensate.
- G. Additional Monitoring:
 1. Monitor constant and variable motor loads.
 2. Monitor variable-frequency-drive operation.

3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 07 72 00 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- E. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 23 31 13 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect outside air ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.04 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 26 01 00
ELECTRICAL GENERAL PROVISIONS

PART 1 - SUMMARY

- 1.1 This Division of the specification outlines the provisions of the contract work to be performed under this Division.
- 1.2 This Section applies to and forms a part of each section of specifications in Division 26 and all work performed under Division 26, 27 and 28.
- 1.3 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under general requirements.
- 1.4 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.
- 1.5 Where the words 'provide' or 'provision' are used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.
- 1.6 Where items are specified in the singular, this Division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

PART 2 - CONTRACTOR QUALIFICATIONS

- 2.1 The Contractor shall have a current California C-10 Electrical Contractor's license and all individuals working on this project shall have passed the Department of Industrial Relations Division of apprenticeship Standards – "Electrician Certification Program."

PART 3 - CODES, PERMITS AND FEES

- 3.1 Comply with all applicable laws, ordinances, rules, regulations, codes, or rulings of governmental units having jurisdiction as well as standards of NFPA and serving utility requirements.
- 3.2 Obtain permits, fees, inspections, meter and the like, associated with work in each section of this Division.
- 3.3 Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

PART 4 - EXAMINATION OF PREMISES

- 4.1 Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

PART 5 - STANDARDS

- 5.1 The following standard publications of the latest editions enforced, and supplements thereto shall form a part of these specifications. All electrical work must, as a minimum, be in accordance with these standards.
 - 5.1.1 2019 California Electrical Code (CEC), Part 3 Title 24 CCR.
 - 5.1.2 National Fire Protection Association.
 - 5.1.3 Underwriters' Laboratories, Inc. (UL).
 - 5.1.4 Certified Ballast Manufacturers' Association (CBM).
 - 5.1.5 National Electrical Manufacturers' Association (NEMA).
 - 5.1.6 Institution of Electrical & Electronics Engineers (IEEE).
 - 5.1.7 American Society for Testing & Materials (ASTM).
 - 5.1.8 National Board of Fire Underwriters (NBFU).
 - 5.1.9 National Board of Standards (NBS).
 - 5.1.10 American National Standards Institute (ANSI).
 - 5.1.11 Insulated Power Cable Engineers Association (IPECS).
 - 5.1.12 Electrical Testing Laboratories (ETL).
 - 5.1.13 National Electrical Safety Code (NESC).
 - 5.1.14 2019 California Building Code (CBC), Part 2, Title 24 CCR.
 - 5.1.15 2019 California Fire Code (CFC), Part 9, Title 24, CCR.
 - 5.1.16 2016 NFPA 72 with California State Amendments
 - 5.1.17 National Electrical Testing Association (NETA), 2010 or most current

PART 6 - DEFINITIONS

- 6.1 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings - acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- 6.2 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.
- 6.3 Finish Space: Any space ordinarily visible, including exterior areas.

PART 7 - WORK AND MATERIALS

- 7.1 Unless otherwise specified, all materials must be new and of the best quality. Materials previously incorporated into other projects, salvaged, or refurbished are not considered new. Perform all labor in a thorough and workmanlike manner.
- 7.2 All materials provided under the contract must bear the UL label where normally available. Note that this requirement may be repeated under equipment specifications. In general, such devices as will void the label should be provided in separate enclosures and wired to the labeled unit in proper manner.

PART 8 - SHOP DRAWINGS AND SUBMITTALS

- 8.1 Submit shop drawings and all data in accordance with Division 1 of these specifications and as noted below for all equipment provided under this Division.
- 8.2 Shop drawings submittals demonstrate to the Architect that the Contractor understands the design concept. The Contractor demonstrates their understanding by indicating which equipment and material they intend to furnish and install and by detailing the fabrication and installation methods of material and equipment he intends to use. If deviations, discrepancies, or conflicts between submittals and specifications are discovered either prior to or after submittals are processed, notify the Architect immediately.
- 8.3 Manufacturer's data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.
- 8.4 Index all submittals and reference them to these specifications. All submittal items shall be assembled and submitted, one for each specification section. (Multiple specification sections may be grouped together in one common submittal binder, as long as each individual section is clearly identified.) Partial or incomplete submittal sections will not be reviewed.

PART 9 - EQUIPMENT PURCHASES

- 9.1 Arrange for purchase and delivery of all materials and equipment within 20 days after approval of submittals. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are not on the project in time to expedite completion, the Owner may purchase said equipment and materials and deduct the cost from the contract sum.
- 9.2 Provide all materials of similar class or service by one manufacturer.

PART 10 - COOPERATIVE WORK

- 10.1 Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration.
- 10.2 Cooperative work includes: General supervision and responsibility for proper location and size of work related to this Division, but provided under the other sections of these specifications, and installation of sleeves, inserts, and anchor bolts for work under each section in this Division.

PART 11 - VERIFICATION OF DIMENSIONS

- 11.1 Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.
- 11.2 Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact location, routes, building obstructions, etc. and install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, keep openings and passageways clear, and maintain proper clearances.

PART 12 - CLOSING-IN OF UNINSPECTED WORK

- 12.1 Cover no work until inspected, tested, and approved by the Architect. Where work is covered before inspection and test, uncover it and when inspected, tested, and approved, restore all work to original proper condition at no additional cost to Owner.

PART 13 - EXCAVATION AND BACKFILL

- 13.1 All excavation and backfill shall be in accordance with Division 1 of these specifications and as noted below.
- 13.2 Perform all necessary excavation, shoring, and backfilling required for the proper laying of all conduits inside the building and premises, and outside as may be necessary.
- 13.3 Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the conduits, doing the remainder by hand. Do not cut any trench near or under footings without first consulting the Architect. All trenches shall be done in accordance with OSHA standards and regulations.
- 13.4 Backfilling shall be done with each layer compacted before another layer is added. No stones or coarse lumps shall be laid directly on a conduit or conduits.

- 13.5 Trenches shall be filled with the specified material. Sod, if any, shall be removed in cut sections and replaced in same manners.
- 13.6 Provide pumps and drainage of all open trenches for purposes of installing electrical duct and wiring.
- 13.7 Perform all backfilling in accordance with the requirements of and under the direction of the Geotechnical Engineer.
- 13.8 Where new underground trenching is required on sites or in any area where existing underground utilities exist, the Contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the Contractor shall hand dig those areas to avoid disruption. The Contractor shall be responsible for immediate repairs to existing underground utilities damaged during construction. The Contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the Contractor shall notify underground service alert in addition to the independent locating service 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133.

PART 14 - CONCRETE

- 14.1 Where used for structures to be provided under the contract such as bases, etc., concrete work, and associated reinforcing shall be as specified under Division 3 of these specifications.
- 14.2 See other sections for additional requirements for underground vaults, cable ducts, etc.

PART 15 - ACCESSIBILITY

- 15.1 Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building.
- 15.2 All required access doors or panels in walls and ceilings are to be furnished and installed as part of the work under this Section. Refer to Division 1 of these specifications and as noted below.
- 15.3 Where located in fire rated assemblies, provide doors which match the rating of the assembly and are approved by the jurisdictional authority.
- 15.4 Refer to 'finish schedule' for types of walls and ceilings in each area and the architectural drawings for rated wall construction.
- 15.5 Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

PART 16 - FLASHING

- 16.1 Flash and counter flash all conduits penetrating roofing membrane as shown on Architectural drawings. All work shall be in accordance with Division 7 of these specifications.

PART 17 - IDENTIFICATION OF EQUIPMENT

- 17.1 All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedules:

17.1.1 General:

- 17.1.1.1 In general, the installed laminated nameplates as hereinafter called for shall also clearly indicate its use, areas served, circuit identification, voltage and any other useful data.

- 17.1.1.2 All auxiliary systems, including communications, shall be labeled to indicate function.

17.1.2 Lighting and Local Panelboards:

- 17.1.2.1 Panel identification shall be with white and black micarta nameplates. Letters shall be no less than 3/8" high.

- 17.1.2.2 Circuit directory shall be two column typewritten card set under glass or glass equivalent. Each circuit shall be identified by the room number and/or number of unit and other pertinent data as required.

17.1.3 Distribution Switchboards and Feeders Sections:

- 17.1.3.1 Identification shall be with 1" x 4" laminated white micarta nameplates with black lettering on each major component, each with name and/or number of unit and other pertinent data as required. Letters shall be no less than 3/8" high.

- 17.1.3.2 Circuit breakers and switches shall be identified by number and name with 3/8" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to or on circuit breaker or switch.

17.1.4 Disconnect Switches, Motor Starters and Transformers:

- 17.1.4.1 Identification shall be with white micarta laminated labels and 3/8" high black lettering.

- 17.1.5 All communication system terminal boxes including T.V., telephone/intercom, security, fire alarm, clock, and computer networking shall be provided with white micarta laminated labels and 3/8" high black lettering.

PART 18 - CONSTRUCTION FACILITIES

- 18.1 Furnish and maintain from the beginning to the completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by City, State Laws, and OSHA to avoid injury or damage to any persons and property.
- 18.2 Temporary power and lighting for construction purposes shall be provided under this Section. All work shall be in accordance with Division 1 of these specifications.

PART 19 - GUARANTEE

- 19.1 Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defect of material and workmanship for one year from date of final acceptance, as outlined in the general conditions. Replace without charge any material or equipment proven defective during this period. The guarantee shall include performance of equipment under all site conditions, conditions of load, installing any additional items of control and/or protective devices, as required.

PART 20 - PATENTS

- 20.1 Refer to the General Conditions for Contractor's responsibilities regarding patents.

PART 21 - PLUMBING (DIVISION 22) / HEATING, VENTILATING, AND AIR CONDITONING (DIVISION 23) / ELECTRICAL – COORDINATION REQUIREMENTS

- 21.1 All electrical work performed for this project shall conform to the California Electrical Code, to Local Building Codes and in conformance with Division 22, 23, and 26 of these specifications, whether the work is provided under the "Plumbing", "Heating, Ventilating, and Air Conditioning", or the "Electrical" Division of these specifications. Where the Division 22 and/or Division 23 Contractor is required to provide electrical work, he shall arrange for the work to be done by a licensed Division 26 Contractor, using qualified electricians. The Division 22 and/or Division 23 Contractor shall be solely and completely responsible for the correct functioning of all equipment regardless of who provided the electrical work.
- 21.2 The work under Division 22 and/or Division 23 shall include the following:
- 21.2.1 All motors required by mechanical equipment.
- 21.2.2 All starters for mechanical equipment which are not provided under the electrical division as part of a motor control center or otherwise indicated on the electrical drawings.

- 21.2.3 All wiring interior to packaged equipment furnished as an integral part of the equipment.
- 21.2.4 All control **wiring and conduit** for mechanical control systems.
- 21.2.5 All control systems required by mechanical equipment.
- 21.3 The work under Division 26 shall include the following:
 - 21.3.1 All power wiring and conduit; and conduit only for EMS control conductors between each building and the main control panel.
 - 21.3.2 Electrical disconnects as shown on the electrical drawings.
 - 21.3.3 Starters forming part of a motor control center.
- 21.4 All power wiring and conduit to equipment furnished under Division 22 and/or Division 23 shall be provided under Division 26. Control wiring and conduit, whether line voltage or low voltage, shall be provided under the division which furnishes the equipment.
- 21.5 Power wiring shall be defined as all wiring between the panelboard switchboard overcurrent device, motor control center starter or switch, and the safety disconnect switch or control panel serving the equipment. Also, the power wiring between safety disconnect switch and the equipment line terminals.
- 21.6 Control wiring shall be defined as all wiring, either line voltage or low voltage, required for the control and interlocking of equipment, including but not limited to wiring to motor control stations, solenoid valves, pressure switches, limit switches, flow switches, thermostats, humidistats, safety devices, smoke detectors, and other components required for the proper operation of the equipment.
- 21.7 All motor starters which are not part of motor control centers and which are required for equipment furnished under this Division shall be furnished and installed by the Division furnishing the equipment and power wiring connected under Division 26. Motor starters and control devices in motor control centers shall be furnished and installed under Division 26.
- 21.8 Division 26 Contractor shall make all final connections of power wiring to equipment furnished under this Division.
- 21.9 Wiring diagrams complete with all connection details shall be furnished under each respective Section.
- 21.10 Motor starters supplied by Plumbing and/or Heating, Ventilating and Air Conditioning shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R/12 gasketed

enclosures in wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided. Acceptable manufacturers are Allen Bradley, General Electric, Square D, Furnas and Cutler Hammer.

PART 22 - EQUIPMENT ROUGH-IN

- 22.1 Rough-in all equipment, fixtures, etc. as designed on the drawings and as specified herein. The drawings indicate only the approximate location of rough-ins. Mounting heights of all switches, receptacles, wall mounted fixtures and such equipment must be coordinated with the Architectural Designs. The Contractor shall obtain all rough-in information before progressing with any work for rough-in connections. Minor changes in the contract drawings shall be anticipated and provided for under this Division of the specifications to comply with rough-in requirements.

PART 23 - OWNER FURNISHED AND OTHER EQUIPMENT

- 23.1 Rough-in and make final connections to all Owner furnished equipment shown on the drawings and specified, and all equipment furnished under other sections of the specifications.

PART 24 - EQUIPMENT FINAL CONNECTIONS

- 24.1 Provide all final connections for the following:
- 24.1.1 All equipment furnished under this Division.
 - 24.1.2 Electrical equipment furnished under other sections of the specification.
 - 24.1.3 Owner furnished equipment as specified under this Division.

PART 25 - INSERTS, ANCHORS, AND MOUNTING SLEEVES

- 25.1 Inserts and anchors must be:
- 25.1.1 Furnished and installed for support of work under this Division.
 - 25.1.2 Mounting of equipment that is of such size as to be free standing and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle of Unistrut or B-line systems with all unfinished edges painted.
 - 25.1.3 Furnish and install all sleeves as required for the installation of all work under all Sections of this Division and for all communication systems including any

communication systems described in this Section which are bid to the General Contractor. Sleeves through floors, roof, and walls shall be as described in "Conduit and Fittings" Section 26 05 33.

PART 26 - SEISMIC ANCHORING

- 26.1 All switchgear and other free-standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.
- 26.2 All sound systems, communication, signal or data networking equipment or enclosures shall be anchored to the structure. The Contractor shall submit drawings signed by the Contractors registered Structural Engineer indicating method of compliance prior to installation.

PART 27 - RUST PROOFING

- 27.1 Rust proofing must be applied to all ferrous metals and shall be in accordance with Section 055000 of these specifications and as noted below.
 - 27.1.1 Hot-dipped galvanized shall be applied and after forming of angle-iron, bolts, anchors, etc.
 - 27.1.2 Hot-dipped galvanized coating shall be applied after fabrication for junction boxes and pull boxes cast in concrete.

PART 28 - GENERAL WIRING

- 28.1 Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have depth sufficient to maintain wall coverage in rear by masonry wall.
- 28.2 In those instances where outlet boxes, recessed terminal boxes, or recessed equipment enclosures are installed in a fire rated assembly, provide "Flamesafe FSD 1077" fire stopping pads or approved equal, over the outlet or box.
- 28.3 Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or with the Architect as the case may be for complete and accurate requirements to result in a neat, workmanlike installation.

PART 29 - SEPARATE CONDUIT SYSTEMS

- 29.1 Each electrical and signal system shall be contained in a separate conduit system as shown on the drawings and as specified herein. This includes each power system, each

lighting system, each signal system of whatever nature, telephone, standby system, sound system, control system, fire alarm system, etc.

- 29.2 Further, each item of building equipment must have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, having separate conduit for larger sizes.

PART 30 - CLEANUP

- 30.1 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.
- 30.2 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- 30.3 During the progress of the work, keep the premises clean and free of debris.

PART 31 - UTILITY SERVICES

- 31.1 The Division 26 Contractor shall contact the serving utility companies; notify the serving power, telephone and cable TV utilities of the following:
- 31.1.1 Name and address of Contractor.
- 31.1.2 Estimated times of construction start, completion and required service connections.
- 31.1.3 Project service voltage, phase load, and service size.
- 31.1.4 Provide to the Architect written verification from each utility company indicating their concurrence with the contract documents.
- 31.2 Contractor shall notify underground service alert 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133. All work shall be in accordance with the Division 1 Sections of these specifications.
- 31.3 All utility company requirements shall be complied with and approval shall be obtained from the utility company for service equipment. Such as, verification of a field test of the ground fault protection on the main service equipment, panic hardware and etc.

PART 32 - TEST AND INSPECTION PROCEDURES – EXISTING MEDIUM VOLTAGE, AIR INSULATED, CIRCUIT BREAKER TESTS

- 32.1 Tests shall be done in accordance with ANSI/NETA Standards and by a contractor certified in medium voltage testing and procedures. Contractor qualifications shall be submitted to the electrical engineer of record for approval.
- 32.2 Testing shall not be done or scheduled until the outage is scheduled and approved by the owner. Outage shall not exceed 24 hours unless approved by the owner and coordinated with the CM and Architect of Record.
- 32.3 Visual and Mechanical Inspection
 - 32.3.1 Inspect physical and mechanical condition.
 - 32.3.2 Inspect anchorage, alignment, and grounding.
 - 32.3.3 Verify that all maintenance devices are available for servicing and operating the breaker.
 - 32.3.4 Clean the Unit.
 - 32.3.5 Inspect arc chutes.
 - 32.3.6 Inspect moving and stationary contacts for condition, wear, and alignment.
 - 32.3.7 Close/open breaker and check for binding, friction, contact alignment, contact sequence, and penetration.
 - 32.3.8 Perform all mechanical operation tests on the operating mechanism in accordance with manufacturer's published data.
 - 32.3.9 Inspect bolted electrical connections for high resistance using one of the following methods:
 - 32.3.9.1 Use of a low-resistance ohmmeter in accordance with Section 33.4.
 - 32.3.9.2 Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 32.3.9.3 Perform a thermographic survey in accordance with NETA standards.
 - 32.3.10 Verify cell fit and element alignment.
 - 32.3.11 Verify racking mechanism operation.
 - 32.3.12 Inspect puffer operation.
 - 32.3.13 Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

32.3.14 Record as-found and as-left operation-counter readings.

32.4 Electrical Tests

32.4.1 Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable. See Section 33.3.

32.4.2 Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data.

32.4.3 Perform a contact/pole-resistance test.

32.4.4 With the breaker in a test position, perform the following tests:

32.4.4.1 Trip and close breaker with the control switch.

32.4.4.2 Trip breaker by operating each of its protective relays. Recalibrate and adjust relay settings based on time current study to be done for the project.

32.4.4.3 Verify mechanism charge, trip-free, and antipump functions.

32.4.4.4 Verify blowout coil circuit continuity.

32.4.4.5 Verify operation of heaters, if applicable.

32.4.4.6 Test instrument transformers in accordance with NETA standards.

32.5 Test Values

32.5.1 Test Values – Visual and Mechanical

32.5.1.1 Bolt-torque levels should be in accordance with manufacturer's published data.

32.5.1.2 Results of the thermographic survey shall be in accordance with NETA standards.

32.5.1.3 Compare travel and velocity values to manufacturer's published data.

32.5.2 Test Values – Electrical

32.5.2.1 Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

- 32.5.2.2 Circuit breaker insulation resistance should be in accordance with manufacturer's published standards.
- 32.5.2.3 Insulation-resistance values of circuit breakers should be in accordance with manufacturer's published data. Values of insulation resistance less than manufacturer's recommendations should be investigated.
- 32.5.2.4 Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate values that deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
- 32.5.2.5 Breaker mechanism charge, close, open, trip, trip-free, and antipump features shall function as designed.
- 32.5.2.6 Minimum pickup for trip and close coils shall be in accordance with manufacturer's published data.
- 32.5.2.7 Power-factor or dissipation-factor and capacitance values should be within ten percent of nameplate rating for bushings. Hot collar tests are evaluated on a milliampere/milliwatt loss basis, and the results should be compared to values of similar bushings.
- 32.5.2.8 If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the over potential test, the circuit breaker is considered to have passed the test.
- 32.5.2.9 The blowout coil circuit should exhibit continuity.
- 32.5.2.10 Heaters should be operational.
- 32.5.2.11 The results of instrument transformer tests shall be in accordance with manufacturer's standards.

PART 33 - PAINTING

- 33.1 Paint all unfinished metal as required in accordance with Division 1 of these specifications. (Galvanized and factory painted equipment shall be considered as having a sub-base finish.)

PART 34 - GENERAL DEMOLITION REQUIREMENTS

- 34.1 Remove existing work and items which are required to be removed in such manner that minimum damage and disturbance is caused to adjacent and connection work scheduled to remain. Repair or replace existing work schedule.

- 34.2 Include preparation of existing areas to receive new materials and removal of materials and equipment to alter or repair the existing building as indicated and as specified.
- 34.3 Perform demolition exercising proper care to prevent injury to the public, workmen and adjoining property.
- 34.4 Perform the removal, cutting, drilling of existing work with extreme care and use small tools in order not to jeopardize the structural integrity of the building.
- 34.5 Rebuild to existing condition or better, existing work which has to be removed to allow the installation of new work as required.
- 34.6 Remove, protect and reinstall existing items as indicated. Replace materials scheduled for reuse which are damaged by the Contractor to the extent that they cannot be reused, with equal quality material, and installation.
- 34.7 Do not reuse in this project materials and items removed from existing site or building, except with specific written approval by the Architect in each case, unless such removed material or item is specifically indicated or specified to be reused.
- 34.8 Remove materials and equipment indicated to be salvaged for reinstallation and store to prevent damage and reinstall as the work progresses. Do not reuse in this project, other materials and equipment removed from existing site or building, except with specific written approval by the Architect in each case.
- 34.9 Patch areas requiring patching, including damage caused by removing, relocating or adding fixtures and equipment, damages caused by demolition at adjacent materials.
- 34.10 Do not stockpile debris in the existing building, without the approval of the Architect. Remove debris as it accumulates from removal operations to a legal disposal area.
- 34.11 Contractor to assume existing oil filled and dry transformers, oil switches, ballasts, lamps, wooden poles, cross arms, computers, computer monitors, and conductor insulation containing materials considered hazardous. Comply with local, state and federal regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution. Contractor shall be responsible for removal of the above hazardous materials where encountered. Include all costs for such removal as part of this contract.
- 34.12 All fluorescent, compact fluorescent, high intensity discharge, metal halide, mercury vapor, high and low-pressure sodium, and neon lamps are to be disposed of as required by the California Waste Rule Regulations as described in the California Code of Regulations, Title 22, Division 4.5 and Chapter 23.
- 34.13 **Communication System:** Where new communication systems, (including telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) are installed to replace existing systems, unless where otherwise directed the existing

systems shall remain fully operational until the new system has been installed and tested. Demolition of the existing systems shall include removal of all equipment and associated wiring and exposed conduits and providing new blank covers for all abandoned device locations.

- 34.14 **Salvage Power Equipment:** The Contractor shall carefully remove all existing switchboards, panelboards, transformers, and confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.
- 34.15 **Salvage Lighting Equipment:** The Contractor shall confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.
- 34.16 **Salvage Communication Equipment:** The Contractor shall carefully remove all communication devices (telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) and box each type of devices separately. The Contractor shall deliver all items to the Owner's maintenance facility.

PART 35 - PROJECT CLOSEOUT

- 35.1 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division, in accordance with Division 1 of these specifications and as described below.
- 35.2 Equipment Lists and Maintenance Manuals:
 - 35.2.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this Section of the specifications:
 - 35.2.1.1 Name, model, and manufacturer.
 - 35.2.1.2 Complete parts drawings and lists.
 - 35.2.1.3 Local supply for parts and replacement and telephone number.
 - 35.2.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.
- 35.3 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and

maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

PART 36 - RECORD DRAWINGS

- 36.1 The Division 26 Contractor shall maintain record drawings as specified in accordance with Division 1 of these specifications, and as noted below.
- 36.2 Drawings shall show locations of all concealed underground conduit runs, giving the number and size of conduit and wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all of the actual additions or changes made. All as-built drawing information shall be prepared by the contractor in AutoCAD, updating the contract computer files as needed to reflect actual installed conditions for all site plans, lighting, power, communication, networking, audio visual, security or fire alarms systems included in the scope of work for this project.
- 36.3 One set of these record drawings shall be delivered to the Architect. The engineer will review documents for completeness and will not be responsible for editing contractor computer files.

PART 37 - CHANGES AND EXTRA WORK

- 37.1 When **changes** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:
 - 37.1.1 The material Costs shall **not exceed** the latest edition of the "Trade Service" end column "C" price list. The materials prices may be higher only where the Contractor can produce invoices to substantiate higher material costs. The Contractor shall submit a print out copy of the trade service sheets with the change order to substantiate these values.
 - 37.1.2 The labor Costs shall **not exceed** the latest edition of the "NECA Manual of Labor Units" **normal column**.
- 37.2 When **credits** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:
 - 37.2.1 The Material Costs shall **not be less than 80% of** the latest edition of the "Trade Service" end column price list. The materials prices may be lower only where

the Contractor can produce invoices to substantiate lower material costs. Restocking fees may also be included in this amount where applicable.

37.2.2 The Labor Costs shall **not be less than 80% of** the latest edition of the “NECA Manual of Labor Units” **normal column**.

37.3 Conduit pricing for conduits of all types sized 3" or smaller.

When changes in the scope of work require the Contractor to estimate conduit Installations, they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for conduit installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.3.1 Couplings.

37.3.2 Set Screw or Compression Fittings, locknuts, Bushings and washers.

37.3.3 Conduit straps and associated screws or nails.

37.3.4 LB fittings or other specialty fittings or specialty mounting hardware may be included where needed.

37.4 Wire pricing for all types and sizes.

When changes in the scope of work require the Contractor to estimate wire installations, they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for wire installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.4.1 Locknuts, Bushings, tape, wire markers.

37.5 When changes in the scope of work require other equipment installations such as lighting fixtures, panelboards, switchboards, wiring devices, communications equipment etc. the Contractor shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for these equipment items represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.5.1 Associated screws, nails, bolts, anchors or supports.

37.5.2 Locknuts, washers, tape.

37.6 The total labor hours for extra work will be required to be calculated as follows:

37.6.1 Change orders with 1 to 30 total labor hours

General Laborer	10%	of total labor hours
Journeyman	10%	of total labor hours
Foreman	80%	of total labor hours

37.6.2 Change orders with 31 to 100 total labor hours

General Laborer	20%	of total labor hours
Journeyman	40%	of total labor hours
Foreman	40%	of total labor hours

37.6.3 Change orders with over 100 total labor hours

General Laborer	30%	of total labor hours
Journeyman	50%	of total labor hours
Foreman	20%	of total labor hours

37.7 When change orders are issued which allow the work to be completed in the normal sequence of construction, the labor rates shall be based on the most current “Prevailing Wage” – straight time total hourly rate. When change orders require the Contractor to work out of sequence the “Prevailing Wage”– daily overtime hourly rate shall apply. Special condition situations shall be reviewed on an individual basis for alternate hourly rate schedules.

37.8 Costs **will not** be permitted for additional supervision on site or office time for processing any change order other than the 10% overhead allowance as described in Division 1. Cost for special equipment required to install items for an individual change order are permitted and must be individually identified. Lump Sum cost for small tools or any other cost not specifically required for the change order are not permitted.

37.9 Contractor estimates shall be formatted to clearly identify each of the following:

37.9.1 Line item description of each type of material or labor item.

37.9.2 Description of quantity for each item.

37.9.3 Description of (material cost per / quantity).

37.9.4 Description of (labor cost per / quantity).

37.9.5 Description of total labor hour breakdown per Foreman, Journeyman or General Laborer as described above.

PART 38 - ELECTRONIC FILES

- 38.1 The Contractor shall make a ***written*** request directly to Johnson Consulting Engineers for electronic drawing files. As a part of the written request, please include the following information:
- 38.1.1 Clearly indicate each drawing sheet needed (i.e., E1.1, E2.1, etc.).
 - 38.1.2 Identify the name, phone number, mailing address and e-mail address of the person to receive the files.
 - 38.1.3 Provide written confirmation and agreement with the requirements described for payment of computer files, as described below.
- 38.2 Detail or riser diagram sheets, or any other drawings other than floor plans or site plans, ***will not be made available to the Contractor.***
- 38.3 Files will only be provided in the AutoCAD format in which they were created.
- 38.4 Requests for files will be processed as soon as possible; a minimum of 7 working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use.
- 38.5 CAD files will be made available via e-mail or on disk, depending on the quantity of files requested. The Contractor requesting the files will be required to pay \$50.00 per drawing plan, or \$300.00 maximum, whichever is ***less***.

END OF SECTION

SECTION 26 05 19
POWER CONDUCTORS

PART 1 – GENERAL

- 1.1 Furnish and install wire and cable for branch circuits and feeders specified herein and as shown on the electrical drawings.
- 1.2 Submittals: Submit manufacturers' data for the following items:
 - 1.2.1 All cables and terminations
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed

PART 2 – PRODUCTS

- 2.1 Wire and cable Rated 120 volt to 600 volt.
 - 2.1.1 All wire and cable shall be new, 600 volt insulated copper, of types specified below for each application. All wire and cable shall bear the UL label and shall be brought to the job in unbroken packages. Wire insulation shall be the color as specified herein and shall be type THWN-2. Insulated conductors shall be installed in all exterior exposed raceways. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems shall be a minimum of No. 12 AWG. Increase conductor size to No. 10 AWG for 120 volt circuits greater than 100 feet from the panel to the load and for 277 volt circuits greater than 200 feet from the panel to the load. Circuit home-runs indicated to be larger than No. 12 must be increased the entire length of the circuit, including equipment grounding conductor. Wire sizes No. 14 through No. 10 shall be solid. No. 8 and larger shall be stranded.
 - 2.1.2 Aluminum conductors will be permitted (only where specifically identified on the drawings. See "600 Volt Feeder Schedule") in sizes 2/0 or larger. Conductors shall be listed by Underwriters Laboratories (UL) and suitable for op

eration at 600 volts or less, at a maximum operating temperature of 90N C maximum in wet or dry locations. Conductors shall be marked "SUN-RES". Aluminum alloy conductors shall be compact stranded conductors of STABILOY® (AA-8030) as manufactured by Alcan Cable or Listed equal. AA-8000 Series aluminum alloy conductor material shall be recognized by The Aluminum Association.

2.1.3 MC type armored cable reference Section 26 05 33.

2.2 Wire and cable for systems below 120 volts.

2.2.1 All low voltage and communications systems cables routed underground shall be provided with a moisture resistant outer jacket, West Penn "Aquaseal" or equal, unless otherwise specified.

PART 3 - EXECUTION

3.1 Wire and cable shall be pulled into conduits without strain using powdered soapstone, mineralac, or other approved lubricant. In no case shall wire be repulled if same has been pulled out of a conduit run for any purpose. No conductor shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.

3.2 All connections of wires shall be made as noted below:

3.2.1 Connections to outlets and switches: Wire formed around binding post of screw.

3.2.2 No. 10 wire and smaller: Circuit wiring connections to lighting fixtures and other hard wired equipment shall be made with pressure type solderless connectors, Buchanan, Scotchlock, Wing Nut, or approved equal. Alternate "WAGO" #773 series or "IDEAL" #32, 33, 34 and 39 series push wire style connectors are also acceptable.

3.3 All wiring shall be continuous without splicing unless where specifically noted on the drawings or where permitted below.

3.3.1 No. 10 wire and smaller above grade: Quantities as needed, connection made with pressure type solderless connectors, Scotchlock or equal.

3.3.2 No. 10 wire and smaller below grade: Quantities as needed, connection made with 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.3 No. 8 wire and larger above grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat

shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.4 No. 8 wire and larger below grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.4 All wiring throughout shall be color coded as follows:

	<u>480 volt system</u>	<u>208 or 240 volt system</u>
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral	Grey	White
Ground	Green	Green

3.5 Wiring must be color coded throughout its entire length, except feeders may have color coded plastic tape at both ends and any other accessible point.

3.6 All control wiring in a circuit shall be color coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color coding.

3.7 At all terminations of control wiring, the wiring shall have a numbered T&B or Brady plastic wire marker.

3.8 Cables when installed are to be properly trained in junction boxes, etc., and in such a manner as to prevent any forces on the cable which might damage the cable.

3.9 All conductors to be installed into a common raceway, shall be pulled into the raceway at the same time.

3.10 All conductors shall be installed in such a manner as to not exceed the manufacturers' recommended pulling tension and bending radius. The equipment used for pulling must be specifically designed for the purpose. Motorized vehicles such as pickup trucks, are not acceptable.

END OF SECTION

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SECTION 26 05 26
GROUNDING

PART 1 – GENERAL

- 1.1 Furnish and install grounding and grounding conductors and electrodes as specified herein and as shown on the drawings.
- 1.2 Submit catalog data for all components.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer’s catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate “or approved equal” statements, or “to be determined later” statements. The products being submitted must be the products installed.

PART 2 – EXECUTION

- 2.1 Grounding
 - 2.1.1 All panelboard cabinets, equipment, enclosures, and complete conduit system shall be grounded securely in accordance with pertinent sections of CEC Article 250. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in CEC Article 250. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.
 - 2.1.2 Provide an insulated equipment grounding conductor in all branch circuit and feeder raceway systems, sized in accordance with CEC 250-1122.
 - 2.1.3 Provide an additional individual insulated grounding conductor for each circuit which contains an isolated ground receptacle or surge suppression receptacle.
 - 2.1.4 Grounding of metal raceways shall be assured by means of provisions of grounding bushings on feeder conduit terminations at the panelboard, and by means of insulated continuous stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.

2.1.5 Except for connections which access for periodic testing is required, make grounding connections which are buried or otherwise inaccessible by exothermite type process.

2.1.6 The following ohmic values shall be test certified for each item listed. A written report signed and witnessed by the project IOR shall be provided to the engineer. If the ohmic value listed cannot be obtained additional grounding shall be installed to reach the value listed.

2.1.6.1 Service.10 ohms.

2.1.6.2 Step down transformers and non-current carrying metal parts
. 25 ohms.

2.1.6.3 Manholes, handholes, etc.
. 10 ohms.

END OF SECTION

SECTION 26 05 33
CONDUIT AND FITTINGS

PART 1 – GENERAL

- 1.1 Furnish and install conduit and fittings as shown on the drawings and as specified herein.
- 1.2 Submit Manufacturer's data on the following:
 - 1.2.1 Conduit.
 - 1.2.2 Fittings
 - 1.2.3 Fire stopping Material.
 - 1.2.4 Surface Raceways.
 - 1.2.5 Type MC or MC-PCS cable, provide construction details and UL "E" number.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Rigid steel conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT) and flexible metallic conduit shall be steel, hot dipped galvanized after fabrication.
- 2.2 PVC conduit shall be Carlon or approved equal.
- 2.3 Liquid tight flexible metal conduit shall be Anaconda Sealtite type UA or approved equal. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or equivalent.
- 2.4 MC type armored cable, when utilized, shall be provided with the following:

- 2.4.1 Comply with UL 1479 and CEC 330
- 2.4.2 90°C, copper, THHN conductors.
- 2.4.3 Minimum #12 insulated grounding conductor.
- 2.4.4 Conductors sized No. 10 and smaller shall be solid, No. 8 and larger shall be stranded.
- 2.4.5 Oversized (150%) neutrals or separate neutrals shall be provided.
- 2.4.6 Increase phase conductors to No. 10 AWG for 120 volt circuits greater than 100 feet from panel to load and for 277 volt circuits greater than 200 feet from panel to load. Where required increase conductor sizes for entire length of circuit.
- 2.4.7 Interlocked armored aluminum sheath.
- 2.4.8 AC or BX type armored cable shall not be substituted in lieu of MC type cable.
- 2.4.9 Color code cable according to cable type and configuration.
- 2.4.10 Acceptable manufacturers are AFC and Alflex.
- 2.5 MC-PCS luminary armored cable , when utilized, shall be provided with the following:
 - 2.5.1 Comply with UL 1479 and CEC 330
 - 2.5.2 90°C, copper, THHN conductors.
 - 2.5.3 Minimum #12 insulated grounding conductor.
 - 2.5.4 Lighting phase conductors sized No. 10 and smaller shall be solid, lighting control conductors shall be sized no. 16 solid.
 - 2.5.5 Interlocked armored aluminum sheath.
 - 2.5.6 AC or BX type armored cable shall not be substituted in lieu of MC type cable.
 - 2.5.7 Color code phase cable according to cable type and configuration. color code control conductors purple/gray.
 - 2.5.8 Acceptable manufacturers are AFC and Alflex.
- 2.6 Fire stopping material shall provide an effective seal against fire, heat, smoke and fire gases. Fire stopping material shall be tested to comply with ASTM E 814 and UL 1479.

The submittal for this product shall include the UL listed system number and installation requirements for each type of penetration seal required for this project.

- 2.7 Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.
- 2.8 All plastic conduit shall be rigid, schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Underground utility company conduits shall comply with local utility co. requirements.
- 2.9 Plastic conduit shall be stored on a flat surface, and protected from the direct rays of the sun.
- 2.10 Where branch circuit or communication raceways cannot be concealed in ceilings or walls and are required to be exposed in interior spaces, provide nonmetallic surface raceway system sized per the manufacturer capacity requirements. A full complement of nonmetallic fittings must be available and matching device boxes and cover plates must be provided. The color of the raceway system, components and boxes shall be (white). Where data networking cabling is to be installed, all raceway fittings shall meet Category 5 radius requirements. Where specific raceway types have been noted on the drawings they shall be as follows:

2.10.1 System 'SR'	Hubbell Wiremold Panduit Hellerman-Tyton	WALLTRAK 1 series ECLIPSE PN05series LD5 series TSR2 series
2.10.2 System 'SR2'	Hubbell Wiremold Panduit Hellerman-Tyton	WALTRAK 22 2300D Series D2P10 TSR3 series
2.10.3 System 'SR3'	Hubbell Wiremold Panduit Hellerman-Tyton	BASETRAK series 5400 - series 70 series MCR Infostream" series

Provide with offset boxes, inline boxes may only be used where specifically shown on the drawings.

PART 3 – FITTINGS

- 3.1 All metallic fittings, including those for EMT, flexible conduit, or malleable iron. Die cast fittings of any other material are not permitted.
- 3.2 Locknuts shall be steel or malleable iron with sharp clean cut threads.

- 3.3 Entrance seals shall be O.Z. type FSK or equivalent.
- 3.4 Bushings and locknuts: Where conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by locknuts on the outside, and a lock nut and plastic bushing on the inside of the box. All conduits shall enter the box squarely.
- 3.5 Furnish and install insulated bushings as per CEC article No. 300 - 4 (F) on all conduits. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.
- 3.6 Transition from plastic to steel conduits shall be with PVC female threaded adaptors.
- 3.7 Couplings and connectors for rigid steel or IMC conduit must be threaded, or compression type (set screw fittings are not permitted).
- 3.8 Couplings and connectors for EMT shall be compression, watertight. Set screw connectors are not acceptable, except for systems below 120 volts.
- 3.9 MC or MC-PCS type armored cable shall be provided with listed clamp type die cast zinc set screw connectors. Anti-short bushings shall be provided at all cable ends.
- 3.10 Connectors for flexible metal conduit shall be steel or malleable iron with screw provided to clinch the conduit into the adapter body. For sizes up to ¾" a screw-in, "Jake type," fitting may be used.
- 3.11 Install approved expansion fittings, or liquid tight flex conduit with a minimum 6" slack for conduits passing through all expansion and seismic joints.

PART 4 - EXECUTION

- 4.1 All branch circuits shall be installed concealed in walls or above ceilings or in concrete floor slabs. PVC conduits installed in concrete floor slabs shall transition to PVC coated rigid steel where conduits penetrate above finished grade or finished floor.
- 4.2 Conduit sizes for various numbers and sizes of wire shall be as required by the CEC, but not smaller than ½" for power wiring and ¾" for communications and fire alarm systems unless otherwise noted. Conduit in slab or below grade shall be ¾" minimum trade size, unless otherwise identified.
- 4.3 Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes to facilitate the ease of pulling. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the CEC. If because of bends or elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.

- 4.4 The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.
- 4.5 Rigid steel conduit or IMC shall be used as follows:
 - 4.5.1 Exposed exterior locations.
 - 4.5.2 Exposed interior locations below eight feet above floor, except in electrical rooms and closets.
 - 4.5.3 In hazardous or classified areas as required by CEC.
- 4.6 EMT conduit shall be used for areas as follows:
 - 4.6.1 All interior communications, signal, and data networking systems.
 - 4.6.2 All interior power wiring systems where not required to be in rigid steel, IMC or flexible conduit.
- 4.7 Flexible conduit shall be used for areas as follows:
 - 4.7.1 To connect motors, transformers, and other equipment subjected to vibration or where specifically detailed on the drawings.
 - 4.7.2 Flexible conduit shall not be used to replace EMT in other locations where the conduit will be exposed.
 - 4.7.3 Flexible metal conduit shall be ferrous. Installation shall be such that considerable slack is realized. The conduit shall contain separate code sized grounding conductor.
 - 4.7.4 Liquid tight flexible conduit shall be used in conformance with CEC in lengths not to exceed 4'. For equipment connections, route the conduit at 90 degrees to the adjacent path for point of connection. The conduit shall contain separate code sized grounding conductor. Use liquid tight flexible conduit for all equipment connections exposed in possible wet, corrosive or oil contaminated areas, e.g., shops and outside areas.
- 4.8 MC armored cable may be used as follows:
 - 4.8.1 All branch circuit wiring for lighting and power circuits where permitted and installed in compliance with UL 1569 and CEC 330.
- 4.9 MC-PCS luminary armored cable may be used as follows:

- 4.9.1 All Lighting branch circuit wiring for lighting circuits where permitted and installed in compliance with UL 1569 and CEC 300-22(c), 330. This cable permits conductors of control circuits to be placed in a cable with lighting power circuits or class 1 circuits.
- 4.9.2 It shall not be considered an acceptable option to install lighting control class 1 circuits as an open wire installation.
- 4.10 MC and MC-PCS armored cable shall **not** be used for the following areas:
 - 4.10.1 Any exterior, underground or buried in concrete circuits.
 - 4.10.2 Any circuits feeding HVAC equipment or pumps or any circuit with 30 AMPs or greater overcurrent protection.
 - 4.10.3 Any exposed interior locations except in electrical, communication or mechanical equipment rooms.
 - 4.10.4 Any exposed interior damp/wet locations, kitchens, science classrooms, shop areas, or concealed in science classroom casework, unless provided with approved PVC jacket.
 - 4.10.5 Any hazardous rated area.
- 4.11 Plastic conduit shall be used for all exterior underground, in slab, and below slab on grade conduit installations. Install bell ends at all conduit terminations in manholes and pull boxes. Where plastic conduit transitions from below grade to above grade, no plastic conduit shall extend above finished exterior grade, or above interior finished floor level.
- 4.12 Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly.
- 4.13 All underground conduit depths shall be as detailed on the drawings or a minimum of 30" below finished grade (when not specifically detailed otherwise), for all exterior underground conduits. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.14 All underground conduits for power systems (600v and higher), shall be concrete encased and a minimum of 48" below grade or as detailed on the drawings. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.

- 4.15 Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.
- 4.16 All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, electrical closets, and in existing or unfinished spaces. No conduit shall be run exposed in finished areas without the specific approval of the Architect.
- 4.17 All raceways which are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other trades piping. Wire shall not be used to support conduit.
- 4.18 It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and boxes, piping, duct work, or structural steel supports, shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines shall be given priority.
- 4.19 Conduits above lay-in grid type ceilings shall be installed in such a manner that they do not interfere with the "lift-out" feature of the ceiling system. Conduit runs shall be installed to maintain the following minimum spacing wherever practical.
- 4.19.1 Water and waste piping not less than 3".
- 4.19.2 Steam and steam condensate lines not less than 12".
- 4.19.3 Radiation and reheat lines not less than 6".
- 4.20 Provide all necessary sleeves and chases required where conduits pass through floors or walls as part of the work of this section. Core drilling will only be permitted where approved by the Architect.
- 4.21 All empty conduits and surface mounted raceways shall be provided with a ¼" polypropylene plastic pull cord and threaded plastic or metal plugs over the ends. Fasten plastic "Dymo" tape label to exposed spare conduit to identify "power" or "communication" system, and to where it goes.
- 4.22 The ends of all conduits shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduits during construction. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.
- 4.23 Bending: Changes in direction shall be made by bends in the conduit. These shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, and in no case smaller than CEC requirements.

- 4.23.1 For power conduits for conductors (600v and below), provide minimum 36" radius (vertical) and 72" radius (horizontal) bends.
- 4.23.2 For power conduits for conductors (greater than 600v), provide minimum 72" radius (vertical) and 72" radius (horizontal) bends.
- 4.24 Supports: Conduit shall be supported at intervals as required by the California Electrical Code. Where conduits are run individually, they shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction. [No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are routed, or above ceilings, they shall be supported by hanger rods and hangers.] Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduits.
- 4.25 Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set flush with surface. A reinforced rod shall be installed through the opening provided in the concrete inserts. Beam clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel 3/8" diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.
- 4.26 All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screws shall be galvanized or cadmium plated. Individual hangers, trapeze hangers and rods shall be prime-coated.
- 4.27 Openings through fire rated floors/walls and/or smoke walls through which conduits pass shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. Sleeves shall be provided for power or communication system cables which are not installed in conduits, and shall be sealed inside and out to comply with manufacturers UL system design details. Where multiple conduits and/or cable tray systems pass thru fire-rated walls at one location, the Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.
- 4.28 Provide cap or other sealing type fitting on all spare conduits. Conduits stubbed into buildings from underground where cable only extends to equipment, the conduit/cable end shall be sealed to prevent moisture from entering the room or space.
- 4.29 All conduits which are part of a paralleled feeder or branch circuit shall be installed underground.

- 4.30 All conduits which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.
- 4.30.1 The Contractor shall coordinate all conduit requirements with each system supplier prior to bid to determine special conduit system requirements.
- 4.30.2 The Contractor shall provide a pull rope in all conduits for these systems.
- 4.30.3 The Contractor shall provide conduit sleeves for all open cable installations thru rated walls or block walls. Provide conduit from each building main termination cabinet or backboard to the nearest accessible ceiling for access into all electrical or communications rooms.
- 4.31 In addition to the above requirements, the following requirements shall apply to all data networking conduits:
- 4.31.1 Flexible metal conduit may only be used where required at building seismic and/or expansion joints.
- 4.31.2 All underground conduits shall be provided with minimum 24" radius elbows (vertical) and 60" (horizontal).
- 4.31.3 No length of conduit above grade shall be installed to exceed 150 feet between pull boxes, or points of connection, unless where specifically detailed on the drawings.
- 4.31.4 No length of conduit shall be installed to exceed two 90 degree bends between pull boxes, or points of connection, unless where specifically detailed on the drawings.
- 4.32 Where surface raceways are installed in interior spaces, the Contractor shall take care to route in straight lines at right angles to or parallel with walls, beams, or columns. All raceways and device boxes shall be securely screwed to the finish surface with zinc screw "Auger" anchors Stk #ZSA1K by Gray Bar Electric or equal. Tape adhesive application will not be permitted.
- 4.33 The Contractor who installs surface raceway systems shall provide and install complete with wire retention clips, one for every (8) vertical feet or (5) horizontal feet or portion thereof. This Contractor shall also provide each raceway channel with pull strings.
- 4.34 It shall be the responsibility of the Contractor installing the raceway to coordinate the installation of raceway device plates and inserts with the communications or data contractors.

- 4.35 MC or MC-PCS cable shall be cut using a specific metallic sheath armor stripping tool. The use of hacksaws, dikes or any other tools not specifically designed to remove the armor sheath will not be permitted.
- 4.36 MC or MC-PCS cables installed in attic spaces or above lay-in ceilings shall be installed to be protected from physical damage. The cable shall be mounted along the sides or bottom of joists, rafters or studs.
- 4.37 Support wires used for supporting ceilings, lighting fixtures or other equipment items shall **not** be used to support MC or MC-PCS cables. Conduits, duct work, piping or any other equipment shall not be used to support or mount MC cables.
- 4.38 MC or MC-PCS cable supports, fasteners and clips shall be designed specifically for use with MC cables. Standard conduit supports, fasteners and clips, nails or other items are not permitted for installing MC cables.

END OF SECTION

SECTION 26 05 34
OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

- 1.1 Furnish and install electrical wiring boxes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Boxes shall be as manufactured by Steel City, Appleton, Raco, or approved equal.
- 2.2 All boxes must conform to the provisions of Article 370 of the CEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Minimum box size shall be 4" square x 1-½" deep.
- 2.3 Boxes generally shall be hot dipped galvanized steel with knockouts. Boxes on exterior surfaces or in damp locations shall be corrosion resistant, cast ferrous and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS, Crouse-Hinds, or the approved equal. Conduit bodies shall be corrosion resistant, cast malleable iron. Conduit bodies shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or the approved equal. Where recessed, boxes shall have square cut corners.
- 2.4 Deep boxes shall be used in wall covered by wainscot or paneling and in walls or glazed tile, brick, or other masonry which will not be covered with plaster. Through the wall type boxes shall not be used unless specifically called for. All boxes shall be nongangable. Boxes in concrete shall be of a type to allow the placing of conduit

without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

- 2.5 All light, switch, receptacle, fire alarm devices and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract.
- 2.6 Pull and junction boxes shall be code gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle from framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas. Covers for flush mounted oversize boxes shall extend $\frac{3}{4}$ " past boxes all around. Covers for 4" square boxes shall extend $\frac{1}{4}$ " past box all around.
- 2.7 All terminal cabinets and junction boxes or equipment back boxes which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.
 - 2.7.1 The Division 26 Contractor shall coordinate all box requirements with each system supplier prior to bid to determine special cabinet or back box requirements. The Contractor shall also provide stainless steel blank cover plates for all low voltage systems installed for future equipment.
 - 2.7.2 The Contractor shall provide all plywood backboards indicated on walls or inside equipment enclosures. All backboards shall be a minimum of $\frac{3}{4}$ " thick fire rated type plywood.
 - 2.7.3 The Contractor shall coordinate exact rough in locations and requirements with each system supplier.
- 2.8 In addition to the above requirements, boxes for data networking wiring and equipment shall comply with the following:
 - 2.8.1 All boxes shall be a minimum of 4-11/16" square x 2-1/8" deep.
 - 2.8.2 Where pull boxes are required on individual conduits 1- $\frac{1}{4}$ " or smaller, provide 4-11/16" square x 2-1/8" deep boxes. Where pull boxes are required on conduits larger than 1- $\frac{1}{4}$ " for straight pull through, provide eight times the conduit trade size for box length. Where pull boxes are required on conduits larger than 1- $\frac{1}{4}$ " for an angle or a U-pull through installation, provide a minimum distance of six times the conduit trade size between the entering and exiting conduit run for each cable.
- 2.9 Recessed boxes installed in fire rated floors/walls and /or smoke walls shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. The Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-ra

ting equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

PART 3 – EXECUTION

- 3.1 Boxes shall be installed where required to pull cable or wire, but in finished areas only by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface mounted boxes shall line up evenly with the edges of the boxes.
- 3.2 Outlets are only approximately located on the plans and great care must be used in the actual location of the outlets by consulting the various detailed drawings and specifications. Outlets shall be flush with finished wall or ceiling, boxes installed symmetrically on such trim or fixture. Refer to drawings for location and orientation of all outlet boxes.
- 3.3 Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Where required, extension rings shall be installed so that the plaster ring is flush with the finished surface.
- 3.4 All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. All wall and ceiling mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.
- 3.5 Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.
- 3.6 Where standby power and normal power are to be located in the same outlet box or 480V in a switch box, install partition barriers to separate the various systems.
- 3.7 All device boxes and junction boxes for fire alarm system shall be painted red and shall be 4-11/16" square by 2-1/8" deep. No exceptions.

END OF SECTION

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SECTION 26 05 43
UNDERGROUND PULL BOXES AND MANHOLES

PART 1 – GENERAL

- 1.1 Furnish and install electrical underground pullboxes and manholes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 The concrete for pull boxes and manholes shall be class 5500 psi or as noted on the drawings. All pullboxes and manholes and covers located in parking lots, driveways, roads, or any other driveable areas shall be traffic rated.
- 2.2 Each manhole shall be provided with a fiberglass ladder and ground rod. Ground rods shall be copper or a copper-clad steel 3/4" diameter by 10-feet long. All non-current carrying metallic components shall be grounded to the ground rods with minimum #6 copper wire.
- 2.3 All underground pullboxes shall be provided with steel bolt down type covers. Bolts shall be bronze or brass. All communication or signal system pullboxes shall be sized to comply with CEC Article 370 unless where other sizes are specifically noted on the drawings.
- 2.4 All underground pullbox and manhole covers shall be provided with either "electrical" or "telephone" or "fire alarm" markings. The telephone marking shall be used to identify telephone, T.V., clock or any other types of communication systems.

- 2.5 All power and communication systems shall be provided with separate pullboxes or manholes. Fire alarm circuits shall also be provided with separate pullboxes from any other type of communication systems.

PART 3 – INSTALLATION

- 3.1 Shoring of the excavation shall be in accordance with all federal, state and local regulations.
- 3.2 Provide sealing material for the joints between sections per manufacturer's instructions.
- 3.3 The contractor shall make the top and access assembly or lid flush with surrounding areas where installed in driveable or normal walking areas.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

RELATED DOCUMENTS

- 1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 27, 28 Specification Sections, apply to this Section.
- 1.2 Acceptance and start-up testing requirements for electrical power distribution equipment and systems. Contractor shall retain and pay for the services of a recognized, independent testing firm for the purpose of performing inspections and tests as herein specified and as required by code.
 - 1.2.1 The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
 - 1.2.2 It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturers tolerances, and is installed in accordance with design specifications.
 - 1.2.3 The tests and inspections shall determine suitability for start-up and energization.
 - 1.2.4 The following equipment shall be tested and calibrated:
 - 1.2.4.1 Medium voltage cables
 - 1.2.4.2 Medium voltage interrupter switches, fuses, and circuit breakers.
 - 1.2.4.3 Low voltage switches, fuses, and circuit breakers, 100A frame and larger.
 - 1.2.4.4 Low voltage cables and feeders.
 - 1.2.4.5 Motor Control Centers and adjustable frequency drives.
 - 1.2.4.6 Protective relays, instruments, and metering systems.

CODES, STANDARDS, AND REFERENCES

- 1.3 All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein.
 - 1.3.1 ANSI/IEEE C2: National Electrical Safety Code (NESC).

- 1.3.2 ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).
- 1.3.3 ANSI/NFPA 70E: Standard for Electrical Safety in the Workplace.
- 1.3.4 ANSI/NFPA 78: Lightning Protection Code.
- 1.3.5 ANSI/NFPA 101: Life Safety Code.
- 1.3.6 American Society for Testing and Materials – ASTM.
- 1.3.7 Applicable State and Local Codes, Ordinances and Standards, including City of San Diego, San Diego Gas & Electric, and San Diego Unified School District.
- 1.3.8 California Code of Regulations (CCR), Title 8, Title 24.
- 1.3.9 Division 1, Section 019113, “General Commissioning Requirements”.
- 1.3.10 Institute of Electrical and Electronic Engineers – IEEE.
- 1.3.11 Insulated Cable Engineers Association – ICEA.
- 1.3.12 International Electrical Testing Association - NETA Accept: The NETA Acceptance Testing Specifications, latest edition.
- 1.3.13 National Electrical Manufacturers Association – NEMA.
- 1.3.14 Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

QUALIFICATION OF TESTING FIRM

- 1.4 All Inspections and tests shall utilize the following references:
 - 1.4.1 Project design specifications.
 - 1.4.2 Project design drawings
 - 1.4.3 Project list of equipment to be inspected and tested
 - 1.4.4 Manufacturer’s instruction manuals applicable to each particular equipment.
- 1.5 The testing firm shall be an independent testing organization 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.
- 1.6 The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems, with at least five (5) years of documented experience.

- 1.7 The lead, on-site, technical person shall be currently certified by the International Electrical Association (NETA), or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.
- 1.8 The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.
- 1.9 The testing firm shall submit proof of the above qualifications with bid documents when requested.
- 1.10 The terms used herein, such as Testing Agency, Testing Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing firm.

SUBMITTALS

- 1.11 Provide submittals per Division 1, Section 013300, "Submittal Procedures".
- 1.12 Qualifications of testing firm and personnel.
- 1.13 Certified test reports.
- 1.14 Two copies of blank forms for checklists, test reports, and other related forms for Engineer's review and approval.

GENERAL REQUIREMENTS

- 1.15 Routine insulation resistance, continuity, and rotation tests for all distribution and utilization equipment shall be performed prior to and in addition to acceptance tests specified herein.
- 1.16 The Testing Firm shall notify the Engineer no fewer than 3 working days prior to commencement of any testing.
- 1.17 Any system, material, or workmanship, which is found defective on the basis of Acceptance Tests shall be reported to the Engineer with recommendations for corrective action.
- 1.18 The Testing Firm shall maintain a written record of all tests, and upon completion of project, shall assemble and certify a final test report.
- 1.19 The final Test Report shall be submitted on conclusion of all required tests and corrective measures.

SAFETY AND PRECAUTIONS

- 1.20 Safety practices shall include, but will not be limited to, compliance with the following requirements:

- 1.20.1 Occupational Safety and Health Act.
- 1.20.2 Accident Prevention Manual for Industrial Operations, National Safety Council.
- 1.20.3 Applicable State and Local safety operating procedures.
- 1.20.4 Owners' Safety Practices.
- 1.20.5 National Fire Protection Association – NFPA 70E.
- 1.20.6 American National Standards for Personnel Protection.
- 1.21 All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and adequate safeguards must be devised.
- 1.22 The Testing Firm shall have a designated safety representative on the project site to supervise the testing operations with respect to safety.
- 1.23 Test Report:
 - 1.23.1 The test report shall include the following:
 - 1.23.1.1 Summary of Project.
 - 1.23.1.2 List of testing equipment used.
 - 1.23.1.3 Calibration date of testing equipment and due date of next calibration.
 - 1.23.1.4 Ambient temperature and humidity at time of test.
 - 1.23.1.5 Listing of equipment tested.
 - 1.23.1.6 Test results.
 - 1.23.1.7 Recommendations.
 - 1.23.2 Furnish original and four copies of the complete report to the Architect/District in accordance with requirements of Contract Documents.

INSPECTION AND TEST PROCEDURES

- 1.24 Contractor shall provide the Testing Firm, a copy of related contract documents such as drawings, specifications, engineer-reviewed submittals, coordination study report including all relay settings and other necessary information.
- 1.25 Contractor shall supply a suitable source of power to each site and location per testing firm requirements.

- 1.26 Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- 1.27 Testing Firm shall review and evaluate all received documents and notify the Contractor and Engineer of any discrepancies in the documents and/or any other requirements immediately.
- 1.28 Testing Firm shall provide and comply with the following:
 - 1.28.1 Acceptance test procedures for each individual equipment listed in Part 1 of this section for Engineer review and approval prior to any test and after thorough evaluation of the system. Testing shall conform to the International Electrical Testing Association (NETA) specifications and standards for electrical power distribution equipment and systems and manufacturer's instructions.
 - 1.28.2 Refer to each individual specification section for testing requirements and comply.
 - 1.28.3 Inspect installed equipment and report any discrepancy and/or deficiency with respect to the contract documents and governing codes prior to testing.

SYSTEM FUNCTION TEST

- 1.29 Perform system function test upon completion of equipment tests as defined in this section. It is the purpose of system function tests to verify proper interaction of all sensing, processing, and action devices.
- 1.30 Implementation.
- 1.31 Submit manufacturers' data on all items:
 - 1.31.1 Develop test parameters for the purpose of evaluation performance of all integral components and their functioning as a complete unit within design requirements.
 - 1.31.2 Test all interlocking devices.
 - 1.31.3 Record the operation of alarms and indicating devices.
- 1.32 DEFICIENCIES
- 1.33 Submit manufacturers' data on all items.
 - 1.33.1 All deficiencies reported by the Testing Firm shall be corrected by the Contractor and Acceptance and System Function Tests shall be repeated to verify conformance with requirements.

PART 2 – PRODUCTS

2.1 Not applicable

PART 3 - EXECUTION

3.1 Not applicable

END OF SECTION

SECTION 26 09 23
DIGITAL LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

- 1.1 Furnish and install automatic lighting controls as shown on the drawings and as specified herein Submit manufacturers' data on all items.
- 1.2 Equipment shall be UL listed, comply with those portions of CEC as applicable to electrical wiring work and comply with those portions of NEMA or UL pertaining to types of electrical equipment and enclosures. The equipment shall also be certified by the California Energy Commission.
- 1.3 The manufacturer of the lighting control equipment shall have been actively engaged in the manufacture of the types and capacities required for the application for at least three years. It is the sole responsibility of the Division 26 contractor to ensure that submittals of material meets the performance specifications contained herein.
- 1.4 All components and assemblies shall be factory pre-tested and burned-in as a system for 48 hours prior to shipping.
- 1.5 Control Intent – Control Intent includes, but is not limited to:
 - 1.5.1 Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
 - 1.5.2 Initial sensor and switching zones
 - 1.5.3 Initial time switch settings
 - 1.5.4 Task lighting and receptacle controls
 - 1.5.5 Emergency Lighting control (if applicable)
 - 1.5.6 Manufacturer shall submit a point-to-point line diagram of the system configuration including all devices and accessories required to complete the system.
 - 1.5.7 Manufacturer shall submit data sheets on the components and system submitted, with descriptions of hardware and software components.

SYSTEM DESCRIPTION & OPERATION

- 1.6 The Lighting Control and Automation system as defined under this section covers the following equipment:

- 1.6.1 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications
- 1.6.2 Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications
- 1.6.3 Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools
- 1.6.4 Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting
- 1.6.5 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities
- 1.6.6 Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities
- 1.6.7 Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings
- 1.6.8 Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices
- 1.6.9 Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control
- 1.6.10 Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
- 1.6.11 Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting

- 1.6.12 Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication
- 1.6.13 LMCP Digital Lighting Management Relay Panel – provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS)
- 1.6.14 Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

LIGHTING CONTROL APPLICATIONS

- 1.7 Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
 - 1.7.1 Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
 - 1.7.2 Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used
 - 1.7.3 Task Lighting / Plug Loads – Provide automatic shut off of non-essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area
 - 1.7.4 Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - 1.7.4.1 All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones

- 1.7.4.2 Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes
- 1.7.4.3 Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings
- 1.7.4.4 Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
- 1.7.5 Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.
- 1.8 Submit shop drawings and manufacturers' data for all components including:
 - 1.8.1 Manufacturer shall submit in bill-of-material form an itemized list of all materials supplied to meet the specification.
 - 1.8.2 Manufacturer shall submit dimensional drawings of lighting control panel(s).
 - 1.8.3 Manufacturer shall submit a point-to-point line diagram of the system configuration including all devices and accessories required to complete the system.
 - 1.8.4 Manufacturer shall submit data sheets on the components and system submitted, with descriptions of hardware and software components
 - 1.8.5 Composite wiring and/or schematic diagram of each control circuit as proposed to be installed
 - 1.8.6 Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans)
 - 1.8.7 Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies
 - 1.8.8 Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate

points of connection to integrated systems. Coordinate integration with mechanical and/or other trades

QUALITY ASSURANCE

1.9 Manufacturer: Minimum 10 years' experience in manufacture of lighting controls

PROJECT CONDITIONS

1.10 Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1.10.1 Ambient temperature: 0° to 40° C (32° to 104° F)

1.10.2 Relative humidity: Maximum 90 percent, non-condensing.

WARRANTY

1.11 Provide a five-year limited manufacturer's warranty on all room control devices and panels

MAINTENANCE

1.12 Spare Parts:

1.12.1 The contactor shall provide as a part of this contract additional Control modules of each type used, Switches of each type used, Daylight sensors, Ceiling mounted occupancy sensors, Wall mounted occupancy sensors, Room controller, etc, three (3) for each type. Any devices not required to be included during construction shall be delivered to the District at the completion of the project. **The quantities of these devices shall be listed as a part of the Phase 1 submittals.**

PART 2 – PRODUCTS

2.1 Acceptable Manufacturers: **WattStopper, Digital Lighting Management (DLM)**

Substitutions:

2.2 Bidder's wishing to obtain approval on manufacturers other than those specified in these specifications or on the drawings shall comply with the following procedures:

2.2.1 All substitution requests shall be submitted to the Architect / Engineer no less than 10 business days prior to the project bid opening date. Approvals when accepted will be issued in the form of an addendum to the contract. No consideration for substitutions will be provided after the award of the contract.

- 2.2.2 The substitution request must include a statement indicating how the substituted product may impact the completion of the project.
 - 2.2.3 The substitution request must include a statement indicating the difference in price (both list price and Contractor price) between the specified product and the substitution.
 - 2.2.4 The substitution request must include a detailed analysis indicating any differences between the specified product and the substitution.
 - 2.2.5 Catalog literature for both the specified and the substitution shall be provided along with contact information of the manufacturer for the substituted product.
- 2.3 The contractor shall pay the Engineer (at their current standard hourly rates) for the time spent reviewing substitutions. These costs will be included as an addendum to be issued to all bidders to include in their proposals, and must be paid to the Engineer within 60 days of award of the project.

DIGITAL LIGHTING CONTROLS

- 2.4 Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

DIGITAL WALL SWITCH OCCUPANCY SENSORS

- 2.5 Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons
- 2.6 Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
- 2.6.1 Digital calibration and pushbutton configuration for the following variables:
 - 2.6.1.1 Sensitivity – 0-100% in 10% increments
 - 2.6.1.2 Time delay – 1-30 minutes in 1 minute increments xx
 - 2.6.1.3 Test mode – Five second time delay
 - 2.6.1.4 Detection technology – PIR, Dual Technology activation and/or re-activation.
 - 2.6.1.5 Walk-through mode

- 2.6.1.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network
- 2.6.2 Programmable control functionality including:
 - 2.6.2.1 Each sensor may be programmed to control specific loads within a local network
 - 2.6.2.2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - 2.6.2.3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
 - 2.6.2.4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 2.6.2.4.1 Ultrasonic and Passive Infrared
 - 2.6.2.4.2 Ultrasonic only
 - 2.6.2.4.3 Passive Infrared only
- 2.6.3 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods
- 2.6.4 Two RJ-45 ports for connection to DLM local network
- 2.6.5 Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote person controls.
- 2.6.6 Device Status LEDs including:
 - 2.6.6.1.1 PIR detection
 - 2.6.6.1.2 Ultrasonic detection
 - 2.6.6.1.3 Configuration mode
 - 2.6.6.1.4 Load binding
- 2.6.7 Assignment of occupancy sensor to a specific load within the room without wiring or special tools

- 2.6.8 Assignment of local buttons to specific loads within the room without wiring or special tools
- 2.6.9 Manual override of controlled loads
- 2.6.10 All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- 2.7 BACnet object information shall be available for the following objects:
 - 2.7.1 Detection state
 - 2.7.2 Occupancy sensor time delay
 - 2.7.3 Occupancy sensor sensitivity, PIR and Ultrasonic
 - 2.7.4 Button state
 - 2.7.5 Switch lock control
 - 2.7.6 Switch lock status
- 2.8 Units shall not have any dip switches or potentiometers for field settings
- 2.9 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required
- 2.10 Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
 - 2.10.1 Left button
 - 2.10.1.1 Press and release – Turn load on
 - 2.10.1.2 Press and hold – Raise dimming load
 - 2.10.2 Right button
 - 2.10.2.1 Press and release – Turn off
 - 2.10.2.2 Press and hold – Lower diming load
- 2.11 Low voltage momentary pushbuttons shall include the following features:
 - 2.11.1 Load/Scene Status LED on each switch button with the following characteristics:
 - 2.11.1.1 Bi-level LED

2.11.1.2 Dim locator level indicates power to switch

2.11.1.3 Bright status level indicates that load or scene is active

2.11.2 The following button attributes may be changed or selected using a wireless configuration tool:

2.11.2.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2.11.2.2 Individual button function may be configured to Toggle, On only or Off only.

2.11.2.3 Individual scenes may be locked to prevent unauthorized change.

2.11.2.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

2.11.2.5 Ramp rate may be adjusted for each dimmer switch.

2.11.2.6 Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple load

2.12 WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening

DIGITAL WALL OR CELING MOUNTED OCCUPANCY SENSOR

2.13 Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor

2.14 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

2.14.1 Digital calibration and pushbutton configuration for the following variables:

2.14.1.1 Sensitivity – 0-100% in 10% increments

2.14.1.2 Time delay – 1-30 minutes in 1 minute increments

2.14.1.3 Test mode – Five second time delay

2.14.1.4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

2.14.1.5 Walk-through mode

- 2.14.1.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
- 2.14.2 Programmable control functionality including:
 - 2.14.2.1 Each sensor may be programmed to control specific loads within a local network.
 - 2.14.2.2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - 2.14.2.3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off
 - 2.14.2.4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 2.14.2.4.1 Ultrasonic and Passive Infrared
 - 2.14.2.4.2 Ultrasonic or Passive Infrared
 - 2.14.2.4.3 Ultrasonic only
 - 2.14.2.4.4 Passive Infrared only
- 2.14.3 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
- 2.14.4 One or two RJ-45 port(s) for connection to DLM local network
- 2.14.5 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls
- 2.14.6 Device Status LEDs, which may be disabled for selected applications, including:
 - 2.14.6.1 PIR detection
 - 2.14.6.2 Ultrasonic detection
 - 2.14.6.3 Configuration mode
 - 2.14.6.4 Load binding

- 2.14.7 Assignment of occupancy sensor to a specific load within the room without wiring or special tools
- 2.14.8 Manual override of controlled loads
- 2.14.9 All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years
- 2.15 BACnet object information shall be available for the following objects:
 - 2.15.1 Detection state
 - 2.15.2 Occupancy sensor time delay
 - 2.15.3 Occupancy sensor sensitivity, PIR and Ultrasonic
- 2.16 Units shall not have any dip switches or potentiometers for field settings
- 2.17 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- 2.18 WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

DIGITAL WALL SWITCHES

- 2.19 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
 - 2.19.1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 2.19.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 2.19.3 Configuration LED on each switch that blinks to indicate data transmission.
 - 2.19.4 Load/Scene Status LED on each switch button with the following characteristics:
 - 2.19.4.1 Bi-level LED
 - 2.19.4.2 Dim locator level indicates power to switch
 - 2.19.4.3 Bright status level indicates that load or scene is active
 - 2.19.5 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps

- 2.19.6 Programmable control functionality including
 - 2.19.6.1 Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority.
 - 2.19.6.2 Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels
- 2.19.7 All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years
- 2.20 BACnet object information shall be available for the following objects:
 - 2.20.1 Button state
 - 2.20.2 Switch lock control
 - 2.20.3 Switch lock status
- 2.21 Two RJ-45 ports for connection to DLM local network
- 2.22 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching
- 2.23 The following switch attributes may be changed or selected using a wireless configuration tool:
 - 2.23.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa)
 - 2.23.2 Individual button function may be configured to Toggle, On only or Off only.
 - 2.23.3 Individual scenes may be locked to prevent unauthorized change.
 - 2.23.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours
 - 2.23.5 Ramp rate may be adjusted for each dimmer switch.
 - 2.23.6 Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads

- 2.24 WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening

HANDHELD REMOTE CONTROLS

- 2.25 Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
- 2.25.1 Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet
 - 2.25.2 LED on each button confirms button press
 - 2.25.3 Load buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads
 - 2.25.4 Inactivity timeout to save battery life
- 2.26 A wall mount holster and mounting hardware shall be included with each remote control
- 2.27 WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105

DIGITAL PARTITION CONTROLS

- 2.28 Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors
- 2.29 Four-button low voltage pushbutton switch for manual control.
- 2.29.1 Two-way infrared (IR) transceiver for use with configuration remote control.
 - 2.29.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall
 - 2.29.3 Configuration LED on each switch that blinks to indicate data transmission.
 - 2.29.4 Each button represents one wall; Green button LED indicates status.
 - 2.29.5 Two RJ-45 ports for connection to DLM local network.
- 2.30 WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening

- 2.31 Contact closure interface for automatic control via input from limit switches on movable walls (by others).
 - 2.31.1 Operates on Class 2 power supplied by DLM local network.
 - 2.31.2 Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
 - 2.31.2.1 Input max. sink/source current: 1-5Ma
 - 2.31.2.2 Logic input signal voltage High: >18VDC
 - 2.31.2.3 Logic input signal voltage Low: <2VDC
 - 2.31.3 Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
 - 2.31.4 Two RJ-45 ports for connection to DLM local network.
- 2.32 WattStopper part number: LMIO-102

DIGITAL DAYLIGHTING SENSORS

- 2.33 Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring
 - 2.33.1 Closed loop sensors measure the ambient light in the space and control a single lighting zone
 - 2.33.2 Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones
 - 2.33.3 Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone
- 2.34 Digital daylighting sensors shall include the following features:
 - 2.34.1 The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers
 - 2.34.2 Sensor light level range shall be from 1-6,553 footcandles (fc).

- 2.34.3 The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
- 2.34.4 For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
- 2.34.5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level
- 2.34.6 Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
- 2.34.7 Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off
- 2.34.8 Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy
- 2.34.9 Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls
- 2.34.10 Configuration LED status light on device that blinks to indicate data transmission
- 2.34.11 Status LED indicates test mode, override mode and load binding.
- 2.34.12 Recessed switch on device to turn controlled load(s) ON and OFF.
- 2.34.13 BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
 - 2.34.13.1 Day and night setpoints
 - 2.34.13.2 Off time delay
 - 2.34.13.3 On and off setpoints
 - 2.34.13.4 Up top three setpoints
 - 2.34.13.5 Operating mode – on/off, bi-level, tri-level or dimming
- 2.34.14 One RJ-45 port for connection to DLM local network

- 2.35 A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well
- 2.36 Any load or group of loads in the room can be assigned to a daylighting zone
- 2.37 Each load within a daylighting zone can be individually enabled or disabled for discrete control) load independence)
- 2.38 All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years

Closed loop digital photosensors shall include the following additional features:

- 2.39 An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
- 2.40 Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software
- 2.41 Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads
- 2.42 WattStopper Product Number: LMLS-400, LMLS-400-L

Open loop digital photosensors shall include the following additional features:

- 2.43 An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room
- 2.44 Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone
- 2.45 Each of the three discrete daylight zones can include any non-overlapping group of loads in the room
- 2.46 WattStopper Product Number: LMLS-500, LMLS-500-L

Dual loop photosensors shall include the following additional features:

- 2.47 Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside.
- 2.48 Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room
- 2.49 Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load
- 2.50 Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is require
- 2.51 Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes
- 2.52 Device must include extendable mounting arm to properly position sensor within a skylight well
- 2.53 WattStopper product number LMLS-600

DIGITAL ROOM CONTROLLERS AND PLUG – LOAD CONTROLLERS

- 2.54 Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n’ Go applications. The control units will include the following features:
 - 2.54.1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room
 - 2.54.2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf
 - 2.54.3 Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID’s from highest to lowest

- 2.54.4 Device Status LEDs to indicate:
 - 2.54.4.1 Data transmission
 - 2.54.4.2 Device has power
 - 2.54.4.3 Status for each load
 - 2.54.4.4 Configuration status
- 2.54.5 Quick installation features including:
 - 2.54.5.1 Standard junction box mounting
 - 2.54.5.2 Quick low voltage connections using standard RJ-45 patch cable
- 2.54.6 Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power
 - 2.54.6.1 Turn on to 100%
 - 2.54.6.2 Remain off
 - 2.54.6.3 Turn on to last level
- 2.54.7 Each load shall be configurable to operate in the following sequences based on occupancy:
 - 2.54.7.1 Auto-on/Auto-off (Follow on and off)
 - 2.54.7.2 Manual-on/Auto-off (Follow off only)
- 2.54.8 The priority of each load output shall be reversible, via digital configuration, so that on is off and off is on
- 2.54.9 BACnet object information shall be available for the following objects:
 - 2.54.9.1 Load status
 - 2.54.9.2 Electrical current
 - 2.54.9.3 Total watts per controller
 - 2.54.9.4 Schedule state – normal or after-hours
 - 2.54.9.5 Demand response control and cap level
 - 2.54.9.6 Room occupancy status

- 2.54.9.7 Total room lighting and plug loads watts
- 2.54.9.8 Total room watts/sq ft
- 2.54.9.9 Force on/off all loads
- 2.54.10 UL 2043 plenum rated
- 2.54.11 Manual override and LED indication for each load
- 2.54.12 Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
- 2.54.13 Zero cross circuitry each load
- 2.54.14 All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- 2.55 On/Off Controllers shall include:
 - 2.55.1 One or two relay configuration
 - 2.55.2 Efficient 150 mA switching power supply
 - 2.55.3 Three RJ-45 DLM local network ports with integral strain relief and dust cover
 - 2.55.4 WattStopper product numbers: LMRC-101, LMRC-102
- 2.56 On/Off/Dimming enhanced Room Controllers shall include:
 - 2.56.1 Real time current monitoring
 - 2.56.2 Multiple relay configurations
 - 2.56.2.1 One, two or three relays (LMRC-21 x series)
 - 2.56.2.2 One or two relays (LMRC-22x series)
 - 2.56.3 Efficient 250 mA switching power supply
 - 2.56.4 Four RJ-45 DLM local network ports with integral strain relief and dust cover
 - 2.56.5 Once dimming output per relay

- 2.56.5.1 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
- 2.56.5.2 Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
- 2.56.5.3 Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver
- 2.56.5.4 The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim
- 2.56.5.5 Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim
- 2.56.5.6 Calibration and trim levels must be set per output channel
- 2.56.5.7 Devices that set calibration or trim levels per controller are not acceptable
- 2.56.5.8 All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable
- 2.56.6 Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events
- 2.56.7 Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value
- 2.56.8 The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 2.56.8.1 Establish preset level for each load from 0-100%
 - 2.56.8.2 Set high and low trim for each load

- 2.56.8.3 Set lamp burn in time for each load up to 100 hours
 - 2.56.9 Override button for each load provides the following functions:
 - 2.56.9.1 Press and release for on/off control
 - 2.56.9.2 Press and hold for dimming control
 - 2.57 WattStopper product numbers: LMRC-211, LRMC-212, LMRC-221, LMRC-222
 - 2.58 Plug Load Room Controllers shall include the following:
 - 2.58.1 One relay configuration with additional connection for unswitched load
 - 2.58.2 Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated)
 - 2.58.3 Factory default operation is Auto-on/Auto-off, based on occupancy
 - 2.58.4 Real time current monitoring of both switched and un-switched load (LMPL-201 only)
 - 2.58.5 Efficient switching power supply
 - 2.58.5.1 150mA (LMPL-101)
 - 2.58.5.2 250mA (LMPL-201)
 - 2.58.6 RJ-45 DLM local network ports
 - 2.58.6.1 Three RJ-45 ports (LMPL-101)
 - 2.58.6.2 Four RJ-45 ports (LMPL-201)
 - 2.59 Wattstopper product numbers: LMPL-101, LMPL-201
- DLM LOCAL NETWORK (Room Network)
- 2.60 The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building
 - 2.61 Features of the DLM local network include:
 - 2.61.1 Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached

- 2.61.2 Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup
 - 2.61.3 Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network
 - 2.61.4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver
- 2.62 Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable
- 2.63 If manufacturer's pre-terminated Cat 5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results
- 2.64 WattStopper Product Number: LMRJ-Series

DLM SEGMENT NETWORK (Room to Room Network)

- 2.65 The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control
- 2.65.1 Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network
 - 2.65.2 Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections
 - 2.65.3 The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms
 - 2.65.4 Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device
 - 2.65.5 Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements

2.65.6 Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERS, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

2.66 WattStopper Product Number: LM-MSTP, LM-MSTP-DB

CONFIGURATION TOOLS

2.67 A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface

2.68 Features and functionality of the wireless configuration tool shall include but not be limited to:

2.68.1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet

2.68.2 High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation

2.68.3 Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number

2.68.4 Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors

2.68.5 Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings

2.68.6 Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls

2.68.7 Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings

2.68.8 Verify status of building level network devices

2.69 WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

NETWORK BRIDGE

- 2.70 The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver
- 2.70.1 The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port
- 2.70.2 Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network
- 2.70.3 The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
- 2.70.3.1 Read/write the normal or after-hours schedule state for the room
- 2.70.3.2 Read the detection state of each occupancy sensor
- 2.70.3.3 Read the aggregate occupancy state of the room
- 2.70.3.4 Read/write the On/Off state of loads
- 2.70.3.5 Read/write the dimmed light level of loads
- 2.70.3.6 Read the button states of switches
- 2.70.3.7 Read total current in amps, and total power in watts through the room control
- 2.70.3.8 Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- 2.70.3.9 Activate a preset scene for the room

- 2.70.3.10 Read/write daylight sensor fade time and day and night setpoints
- 2.70.3.11 Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- 2.70.3.12 Set daylight sensor operating mode
- 2.70.3.13 Read/write wall switch lock status
- 2.70.3.14 Read watts per square foot for the entire controlled room
- 2.70.3.15 Write maximum light level per load for demand response mode
- 2.70.3.16 Read/write activation of demand response mode for the room
- 2.70.3.17 Activate/restore demand response mode for the room

2.71 Wattstopper product number: LMBC-300

SEGMENT MANAGER

- 2.72 For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443)
- 2.73 Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans
- 2.74 Operational features of the Segment Manager shall include the following:
 - 2.74.1 Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic
 - 2.74.2 Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC
 - 2.74.3 Log in security capable of restricting some users to view-only or other limited operations
 - 2.74.4 Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not

be required to provide communication, monitoring or control of all local networks and lighting control panels

- 2.74.5 After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the use
- 2.74.6 Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On
- 2.74.7 Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules
- 2.74.8 Ability to group rooms and loads for common control by schedules, switches or network commands
- 2.74.9 Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature
- 2.74.10 Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control
- 2.74.11 The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable
- 2.75 Segment Manager shall support multiple DLM rooms as follows
 - 2.75.1 Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E)
 - 2.75.2 Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E)
- 2.76 WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16

PROGRAMMING, CONFIGURION AND DOCUMENTATION SOFTWARE

- 2.77 PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication. Additional parameters exposed through this method include but are not limited to:
- 2.77.1 Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 - 2.77.2 Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
 - 2.77.3 Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 - 2.77.4 Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 - 2.77.5 Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
 - 2.77.6 Load control polarity reversal so that on events turn loads off and vice versa.
 - 2.77.7 Per-load DR (demand response) shed level in units of percent.
 - 2.77.8 Load output pulse mode in increments of 1second.
 - 2.77.9 Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer
- 2.78 Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
- 2.78.1 Device list report: All devices in a project listed by type.
 - 2.78.2 Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
 - 2.78.3 BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.

- 2.78.4 Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
- 2.78.5 Device parameter report: Per-room lists of all configured parameters accessible via handheld IR programmer for use with O&M documentation.
- 2.78.6 Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
- 2.78.7 Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors
- 2.79 Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations
 - 2.79.1 Set, copy/paste an entire project site of sensor time delays.
 - 2.79.2 Set, copy/paste an entire project site of sensor sensitivity settings.
 - 2.79.3 Search based on room name and text labels.
 - 2.79.4 Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 - 2.79.5 Filter by parameter value to search for product with specific configurations
- 2.80 Network-wide firmware upgrading remotely via the BACnet/IP network
 - 2.80.1 Mass firmware update of entire rooms
 - 2.80.2 Mass firmware update of specifically selected rooms or areas
 - 2.80.3 Mass firmware upgrade of specific products
- 2.81 WattStopper Product Number: LMCS-100, LMCI-100

LMCP LIGHTING CONTROL PANELS

- 2.82 Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:
 - 2.82.1 Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors
 - 2.82.2 Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel

2.82.3 Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features

2.82.3.1 Removable, plug-in terminal blocks with connections for all low voltage terminations

2.82.3.2 Individual terminal block, override pushbutton, and LED status light for each relay

2.82.3.3 Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only

2.82.3.4 Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices

2.82.3.5 True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet

2.82.3.6 Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously

2.82.3.7 Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99

2.82.3.8 Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state

2.82.3.9 Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

Electrical

- 2.82.3.9.1 30 amp ballast at 277V
- 2.82.3.9.2 20 amp ballast at 347V
- 2.82.3.9.3 20 amp tungsten at 120V
- 2.82.3.9.4 30 amp resistive at 347V
- 2.82.3.9.5 1.5 HP motor at 120V
- 2.82.3.9.6 14,000 amp short circuit current rating (SCCR) at 347V
- 2.82.3.9.7 Relays shall be specifically UL 20 listed for control of plug-loads

Mechanical

- 2.82.3.9.8 Replaceable, ½" KO mounting with removable Class 2 wire harness
- 2.82.3.9.9 Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
- 2.82.3.9.10 Dual line and load terminals each support two #14 - #12 solid or stranded conductors
- 2.82.3.9.11 Tested to 300,000 mechanical on/off cycles

- 2.83 Isolated low voltage contacts provide for true relay status feedback and pilot light indication
- 2.84 Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection
- 2.85 Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700
- 2.86 Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control

- 2.86.1 Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups
- 2.86.2 The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes
- 2.86.3 The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed
- 2.86.4 The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - 2.86.4.1 Scheduled ON / OFF
 - 2.86.4.2 Manual ON / Scheduled OFF
 - 2.86.4.3 Astro ON / OFF (or Photo ON / OFF)
 - 2.86.4.4 Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
- 2.86.5 The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
- 2.86.6 The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years
- 2.86.7 Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable
- 2.87 The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection
- 2.88 The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol

- 2.88.1 The panel shall have provision for an individual BACnet device ID and shall support the full 2^{22} range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network
- 2.88.2 The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second
- 2.88.3 Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property
- 2.88.4 Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64
- 2.88.5 The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode
- 2.88.6 Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
 - 2.88.6.1 Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays
 - 2.88.6.2 Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control
 - 2.88.6.3 Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays
 - 2.88.6.4 Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches
- 2.88.7 The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel

- 2.88.8 The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
- 2.88.9 Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object
- 2.88.10 Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196

2.89 WattStopper Product Number: LMCP8, LMCP24 or LMCP48

USER INTERFACE

- 2.90 Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:
 - 2.90.1 Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
 - 2.90.2 Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
 - 2.90.3 Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
 - 2.90.4 Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
 - 2.90.5 Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.

2.90.6 Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.

2.90.7 An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.

2.91 WattStopper Product Number: LMCT-100

EMERGENCY LIGHTING CONTROL DEVICES

2.92 Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

2.92.1 120/277 volts, 50/60 Hz, 20 amp ballast rating

2.92.2 Push to test button

2.92.3 Auxiliary contact for remote test or fire alarm system interface

2.93 WattStopper Product Numbers: ELCU-100, ELCU-200

PART 3 - EXECUTION

PRE-INSTALLATION MEETING

3.1 A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

3.1.1 Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.

3.1.2 Review the specifications for low voltage control wiring and termination.

3.1.3 Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

3.1.4 Discuss requirements for integration with other trades

CONTRACTOR INSTALLATION AND SERVICES

- 3.2 Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs
- 3.3 Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturers with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings
- 3.4 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication
- 3.5 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings
 - 3.5.1 Adjust time delay so that controlled area remains lighted while occupied
- 3.6 Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - 3.6.1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - 3.6.2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - 3.6.3 Load Parameters (e.g. blink warning, etc)
- 3.7 Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity

FACTORY SERVICES

- 3.8 Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system

- 3.9 The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date
- 3.10 Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system

COMMISSIONING SUPPORT SERVICES

- 3.11 On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
- 3.12 The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents

ACCEPTANCE TESTING SUPPORT SERVICES

- 3.13 On all California projects, a certified lighting controls acceptance test technician (CLCATT) must verify the installation of the lighting control system. Manufacturer should include an extra day of factory technician's time to assist the CLCATT review the functionality and settings of the lighting control hardware per the requirements in the California State forms. It will be the CLCATT's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the CLCATT with this task

END OF SECTION

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SECTION 26 22 13
DRY TYPE TRANSFORMERS

PART 1 – GENERAL

- 1.1 Furnish and install where indicated on the drawings dry type transformers with voltage and phase as shown on the drawings. The transformers shall be 60 Hz with KVA rating as shown on the drawings.
- 1.2 Submit shop drawings and manufacturer’s data for each transformer including:
 - 1.2.1 Incident energy level calculations
- 1.3 **Common submittal mistakes which will result in the submittal being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer’s catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate “or approved equal” statements, or “to be determined later” statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Acceptable manufacturers are Square D, Eaton-Cutler Hammer, Siemens or General Electric.
- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1 are not considered equal, or approved for use on this project.
- 2.3 Energy efficient transformers shall be provided in compliance with NEMA TP-1 and requirements as outlined in the California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4, Sections 1601-1609: Appliance Efficiency Regulations and California Code of Regulations, Title 24: part 6, Subchapter 2, Sections 110-11: Building Standards. Transformers shall also meet the Class 1 Efficiency levels for distribution transformers specified in Table 4-2 of the National Electrical Association (NEMA) TP-102002, Guide for Determining Energy Efficiency for Distribution Transformers” The TP-1 efficiency rating will apply to both conventional transformers and K-rated transformers.
- 2.4 Transformers shall comply with the latest NEMA and ANSI standards.

- 2.5 Transformers shall be encased in a sheet steel enclosure. Ten (10) KVA and smaller shall be non-ventilated, and above 10 KVA shall be ventilated, self-cooled. The core and coil assembly shall be completely isolated from the enclosure by means of neoprene rubber isolation pads or other acceptable vibration isolators. Transformers installed outdoors shall be provided with suitable rain shields and shall be UL listed for outdoor installation.
- 2.5.1 Fan cooled transformers will not be accepted.
- 2.6 Transformers shall have a 185°C insulation system and shall not exceed 115°C rise above a 40°C ambient under full load conditions.
- 2.7 Transformers shall be capable of operating at 100 PCT. for taps below normal. Transformers rated 30 KVA and larger shall be 6 - 2-1/2 PCT., four below, and two above normal.
- 2.8 Transformer cable termination compartment shall be rated at not more than 75 degrees C.
- 2.9 Transformers shall have aluminum windings.
- 2.10 Sound outputs of transformers shall not exceed the following levels, based on NEMA standard testing procedures:

<u>KVA Rating</u>	<u>Decibel Sound Output</u>
0-9	40
10-50	45
51-150	50
151-300	55
301-500	60

PART 3 – EXECUTION

- 3.1 Dry type transformers larger than 112.5KVA rating shall have a minimum of twelve inches clearance between transformer ventilation openings and adjacent structure. Transformer connections shall be made with flexible conduit.
- 3.2 All lugs shall be torque tested in the presence of the inspector of record.
- 3.3 Transformers shall be anchored to the structure to resist seismic activity in accordance with Zone 4 requirements. Provide a minimum of four (4) ½-inch diameter anchor bolts for floor or roof mounted transformers.
- 3.4 Transformers mounted on roofs shall be installed on a roof curb. All conduits shall enter the transformer enclosure within the curbed area.
- 3.5 Arc Flash and Shock Hazard

- 3.5.1 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
- 3.5.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
- 3.5.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
- 3.5.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.

END OF SECTION

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SECTION 26 24 13 SWITCHBOARDS

PART 1 – GENERAL

- 1.1 Furnish and install service entrance and distribution switchboards as herein specified and as shown on the drawings. In order to establish the minimum acceptable quality and type of equipment described in this section, the switchboard was technically and dimensionally designed around "Square D." If other acceptable manufacturer products listed in 2.1 are used, it shall be the responsibility of the Contractor to verify the equipment will meet the requirements of the design, both technically and dimensionally.
- 1.2 All electrical materials and equipment shall be new, and of the type and quality specified: Listed by Underwriters' Laboratories, and bear their label, where standards have been established; in compliance with the applicable standards of CEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. All components and equipment enclosures shall be manufactured by the same manufacturer.
- 1.3 SUBMITTALS
 - 1.3.1 Submit shop drawings and manufacturers' data on the switchboard and components including:
 - 1.3.1.1 Equipment elevation diagrams indicating the bussing configurations and ampere ratings.
 - 1.3.1.2 Coordination study and incident energy level calculations.
 - 1.3.1.3 Metering equipment
 - 1.3.1.4 Breakers or fused switches
 - 1.3.1.5 Surge Protective Device (SPD)
- 1.4 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.4.1 Not including the Short Circuit and Coordination Study with the material submittals.
 - 1.4.2 Not including all items listed in the above itemized description.
 - 1.4.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.4.4 Not including actual manufacturer's catalog information of proposed products.

- 1.4.5 Do not include multiple manufacturers for similar products and do not indicate “or approved equal” statements, or “to be determined later” statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

2.1.1 Acceptable manufacturers are:

2.1.1.1 Siemens

2.1.1.2 Eaton

2.1.1.3 Square D

2.1.1.4 General Electric

2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1, are not considered equal or approved for use on this project.

2.3 Switchboards shall be of the dead front, safety type with voltage and ampere capacity as indicated. Provide a 25% minimum tin plated aluminum ground bus running the full length of the switchboards. The neutral bus shall be **100%** rated throughout.

2.4 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.

2.5 All bussing shall be tin plated aluminum and braced for a short circuit current of 100,000 RMS symmetrical amperes minimum, or as noted on the drawings. Horizontal and vertical bussing shall be 100% fully rated; not tapered unless otherwise noted on the drawings. All sections shall have full height bus.

2.6 The main circuit breaker (480 volt or 208 volt, 800 amp or larger) shall be a stored energy solid state trip insulated case type breaker and shall consist of a three-pole electrically and mechanically trip-free circuit breaker with inter-pole barriers, arc quenchers, manual stored-energy closing mechanism, mechanical push-button trip, position indicator, and equipped for fixed mounting in the switchboard section. Main breaker shall be **100%** rated and shall be sized as indicated on the drawings. Minimum short circuit interrupting rating shall be 65,000 amperes symmetrical for all breakers in the main switchboard or as indicated on the drawings. For main breakers rated 2,500 amps and larger this rating shall be increased to 100,000 amps, or as indicated on the drawings.

2.6.1 The over current trip devices to be furnished with the main circuit breaker shall be of the three-phase construction and employ solid-state components in their design to afford combinations of long, short time, and instantaneous and

ground fault characteristics (480 volt only) as specified. The circuit breaker and integral solid-state trip device shall be self-contained to include necessary power supply, transformers and tapped current level sensing transformers. An external source shall not be required to trip the circuit breaker under fault of overload conditions or to test the ground fault trip.

- 2.6.2 Field installed rating plug taps shall be provided.
- 2.6.3 Main breakers 400 amp and larger shall be solid state trip.
- 2.6.4 The main circuit breaker shall be provided with the following:
 - 2.6.4.1 Adjustable longtime delay element pickup.
 - 2.6.4.2 Adjustable short-time delay element pickup.
 - 2.6.4.3 The instantaneous trip element pickup shall be adjustable from 1.5 to 10 times the sensor setting or none.
- 2.6.5 The feeder circuit breakers (480 volt or 208 volt, 400 amp or larger) shall be solid state trip molded case type breakers. They shall consist of a three-pole electrically and mechanically trip-free circuit breakers with inter-pole barriers, arc quenchers, manual closing mechanism, position indicator, and equipped for fixed mounting in the switchboard section. The breakers shall be a minimum of **80%** rated, unless otherwise identified on the drawings and shall be sized as indicated on the drawings. Minimum short circuit interrupting rating shall be 65,000 amperes symmetrical or as indicated on the drawings.
 - 2.6.5.1 The overcurrent trip devices to be furnished with these circuit breakers shall be of the three-phase construction and employ solid-state components in their design to afford combinations of long, short time, and instantaneous and ground fault characteristics (480 volt only) as specified. The circuit breaker and integral solid-state trip device shall be self-contained to include necessary power supply, transformers and tapped current level sensing transformers. An external source shall not be required to trip the circuit breaker under fault of overload conditions or to test the ground fault trip.
 - 2.6.5.2 Field installed rating plug taps shall be provided as required.
 - 2.6.5.3 These circuit breakers shall be provided with the following:
 - 2.6.5.3.1 Adjustable long-time delay element pickup.
 - 2.6.5.3.2 Adjustable short-time delay element pickup.
 - 2.6.5.3.3 The instantaneous trip element pickup shall be adjustable from 1.5 to 10 times the sensor setting.

2.6.5.3.4 Where the GFI function is required the settings shall be set at maximum levels.

- 2.7 Feeder breakers identified as 100% rating on the drawings may be molded case type below 1600 amp but 1600 amp and above shall be insulated case type. All breakers shall accept copper or aluminum conductors. Contractor must verify that the breaker can accept the possibility of aluminum conductors.
- 2.8 Circuit breakers less than 400 amps shall be molded case, trip free, quick-make, quick-break, thermal magnetic type, with handles clearly indicating rating and position-on, off, tripped.
- 2.9 Circuit breakers used in service entrance equipment, identified on the drawings shall have short circuit current ratings equal to the bracing and in no case smaller than 22,000 amperes RMS symmetrical.
- 2.10 The switchboard shall be manufactured to locate the utility company metering within the local utility company requirements, for maximum centerline height. This maximum height must include the 2-1/2" high (above finished grade) concrete housekeeping.
- 2.11 Provide a metal embossed nameplate adjacent to the switchboard rating, indicating the maximum short circuit current rating of the switchboard as determined by UL 891, September 30, 1982.
- 2.12 Where devices indicated are fusible type, fuses shall be Bussman or Littlefuse (no known equal).
- 2.13 Where a switchboard is indicated to be provided with an NEMA 3R (weatherproof) enclosure, the enclosure shall be manufactured to allow the equipment to mount flush against a vertical surface or wall. Rear roof equipment overhangs will not be permitted for weatherproof equipment.
- 2.14 Where auxiliary test kits or other devices are needed for setting breaker parameters they shall be supplied.

Service Entrance – Surge Protective Device

- 2.15 IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- 2.16 IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- 2.17 IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- 2.18 California Electrical Code: Article 285

- 2.19 UL 1283 - Electromagnetic Interference Filters
- 2.20 SPD shall be UL 1449 labeled as Type 1 or Type 4 intended for Type 1 applications, verifiable at UL.com without need for external or supplemental over current controls. Every suppression component of every mode, including N-G, shall be protected by internal over current and thermal over temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of the specification
- 2.21 SPD shall be factory installed integral to electrical distribution equipment
- 2.22 SPD shall be UL labeled with 20kA I-nominal (I-n)
- 2.23 SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR)
- 2.24 Standard Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems.
- 2.25 SPD shall be connected to the buss of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect
- 2.26 SPD shall meet or exceed the following criteria:
- 2.26.1 MAXIMUM 7-Mode sure current capability per phase shall be 400kA for mountain and desert areas with over 5 lightning strikes per year.
- 2.26.2 UL 1449 – Third Edition Revisions; effective September 29, 2009 Voltage Protection Ratings shall not exceed the following:
- | <u>VOLTAGE</u> | <u>L-N</u> | <u>L-G</u> | <u>N-G</u> | <u>L-L</u> | <u>MCOV</u> |
|----------------|------------|------------|------------|------------|-------------|
| 208Y/120 | 700V | 700V | 700V | 1200V | 150V |
| 480Y/277 | 1200V | 1200V | 1200V | 2000V | 320V |
- 2.26.3 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com)
- | <u>System Voltage</u> | <u>Allowable System Voltage Fluctuation (%)</u> | <u>MCOV</u> |
|-----------------------|---|-------------|
| 208Y/120 | 25% | 150V |
| 480Y/277 | 15% | 320V |
- 2.27 SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of -50dB at 100 kHz
- 2.28 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

- 2.29 SPD shall include a serviceable, replaceable module.
- 2.30 SPD shall be equipped with the following diagnostics:
 - 2.30.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service Led
 - 2.30.2 Audible alarm with on/off silence function and diagnostic test function (excluding branch)
 - 2.30.3 Form C dry Contacts

No other test equipment shall be required for SPD monitoring or testing before or after installation.

- 2.30.4 SPD shall have a 10 year warranty

Short-Circuit and Coordination Studies

- 2.31 The contractor shall provide the following studies; a time current and complete short-circuit study, equipment-interrupting or withstand evaluation, and a protective-device coordination study as described below for the distribution system. The equipment study shall be included with the equipment submittals. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum-fault conditions shall be thoroughly covered in the study. The studies are to be reviewed by a Professional Engineer registered in the State of California.
 - 2.31.1 **All studies shall be performed by “Emerson Electric” (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.**
- 2.32 Short-Circuit Study
 - 2.32.1 The study shall be in accordance with applicable ANSI and IEEE standards.
 - 2.32.2 The study input data shall include the short-circuit single- and three-phase contributions from all sources, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
 - 2.32.3 Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.

2.32.4 For the portions of a system utilizing medium- and high-voltage breakers, separate calculations shall be made for one-half cycle (close and latch) currents and interrupting currents. Calculations shall be for three-phase and phase-to-ground faults at each bus under consideration.

2.32.5 For the portions of a system utilizing low-voltage breakers (less than 1,000 volts), calculations shall be made for three-phase and phase-to-ground interrupting currents at each bus under consideration.

2.33 Equipment Evaluation Study

2.33.1 An equipment evaluation study shall be performed to assure the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the maximum short-circuit momentary and interrupting duties. Series rating of over current protective devices shall be permitted to reduce the maximum available short circuit current to panelboard branch circuit breakers to no more than 10,000 amps symmetrical for the 120/208 volt system and 14,000 amps symmetrical for the 277/480 volt system.

2.34 Protective-Device Coordination Study

2.34.1 A protective-device coordination study shall be performed to select or to verify the selection of power fuse ratings, protective-relay characteristics and settings, ratios, and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings. Time current curves are to be colored to clearly indicate coordination.

2.34.2 The coordination study shall include all voltage classes of equipment from the source's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground over current protection shall be included as well as settings for all other adjustable protective devices. Ground fault settings are to, as a minimum coordinate with a downstream 50 amp branch circuit breaker.

2.34.3 Protective device selection and settings shall be in accordance with requirements of the National Electrical Code and the recommendations of the ANSI/IEEE Standard 399, as applicable.

2.35 Study Report

2.35.1 The results of the power-system studies shall be summarized in a final report. The report shall include the following sections:

2.35.1.1 Description, purpose, basis, and scope of the study and a single-line diagram of the portion of the power system which is included within the scope of study.

- 2.35.1.2 Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties and commentary regarding same.
- 2.35.1.3 Protective device coordination curves, with commentary.
- 2.35.1.4 The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system.
- 2.35.1.5 Fault-current tabulations including a definition of terms and a guide for interpretation.
- 2.35.1.6 The report must be submitted with the material submittal for the engineer's approval.

2.36 Implementation

- 2.36.1 The equipment manufacturer is to be responsible for providing over current devices which are in compliance with the results of the above study.

PART 3 – EXECUTION

- 3.1 Switchboard shall be provided with adequate lifting means and capable of being rolled or moved directly to the floor without the use of floor sills.
- 3.2 Switchboard installation shall be done in accordance with National Electrical Installation Standards (NECA 400-1998) for installing and maintaining switchboards.
- 3.3 Provide 2-1/2" concrete housekeeping pads for service entrance and distribution switchboards. For switchboards containing local utility company metering equipment, the concrete pad must be flush with the front edge of the switchboard enclosure.
- 3.4 Provide permanently affixed engraved nameplate stating UL listed fault current rating of switchboard assembly. Locate adjacent to the equipment nameplate on front of switchboard.
- 3.5 All lugs shall be torque tested in the presence of the inspector of record.
- 3.6 Arc Flash and Shock Hazard
 - 3.6.1 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.

- 3.6.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high. The label is not to identify the party performing the study but only the technical information needed.
- 3.6.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
- 3.6.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.

END OF SECTION

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SECTION 26 24 16
PANEL BOARDS

PART 1 – GENERAL

- 1.1 Furnish and install branch circuit panel boards as specified herein and as indicated on the drawings. Submit manufacturers' data on all items.
- 1.2 Submit manufacturers' data on all panel boards and components including:
 - 1.2.1 Enclosures and covers
 - 1.2.2 Breakers
 - 1.2.3 Surge Protective Device (SPD) equipment
 - 1.2.4 Incident energy level calculations
 - 1.2.5 Common submittal mistakes which will result in the submittals being rejected:
 - 1.2.5.1 Not arranging the circuit breakers in panels to match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
 - 1.2.5.2 Not including all items listed in the above itemized description.
 - 1.2.5.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.2.5.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.2.5.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 The interrupting rating of circuit breakers shall be 10,000 amps for the 120/208 system and 14,000 amp for 277/480 volt systems. Refer to drawings for higher interrupting rating requirements. All components and equipment enclosures shall be manufactured by

the same manufacturer. Circuit breakers shall be permitted to be series rated to limit the available fault current to no more than the above ratings.

- 2.2 All panels shall be fully bussed. Recessed panel enclosures shall be a maximum of 20" wide and 5-3/4" deep for all panels 600 amp rated and less.
- 2.3 All busses shall be tin-plated aluminum and shall be located in the rear of the panelboard cabinet. Individual circuit breakers shall be bolt on type and removable from the cabinet without disturbing the bussing in any way. All panel boards shall contain ground busses.
- 2.4 Panel covers shall be door in door style, with one lock. Door lock shall allow access to breakers only. Access to wireways without removal of cover shall be permitted by (non removable) screws behind the locked door. Panel cover shall be provided with full length piano hinge. All locks for all panels provided in this project shall be keyed alike.
- 2.5 Each panel shall have a two-column circuit index card set under glass or glass equivalent on the inside of the door. Each circuit shall be identified as to use and room or area. Areas shall be designated by room numbers. Room numbers shown on the drawings may change and contractor shall verify final room numbers with the architect prior to project completion.
- 2.6 Tandem mounted or wafer type breakers are not acceptable.
- 2.7 Multiple breakers shall have one common trip handle or be internally connected. Handle ties are not acceptable.
- 2.8 Breaker arrangements shown in the drawings shall be maintained. The circuit breakers in panels must match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
- 2.9 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the panelboard manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.
- 2.10 Acceptable manufacturers are Square D, Eaton, Siemens or General Electric.
- 2.11 Equipment manufactured by any other manufacturers not specifically listed in Section 2.10 are not considered equal, or approved for use on this project.

Surge Protective Device (SPD)

- 2.12 Surge Protective Device (SPD) panelboards, shall be provided with an integrated circuit breaker panelboard and parallel connected suppression / filter system in a single enclosure. The SPD panelboard shall meet the following parameters: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, UL 1283 and the UL 1449, Third Edition, effective September 29, 2009.

2.13 The panelboard shall be UL 67 Listed and the SPD shall be UL 1449 labeled as Type 1 or Type 2 or as Type 4 intended for Type 1 or Type 2 applications. SPD shall be factory installed integral to the panel board.

2.14 The SPD panelboard shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.

2.15 SPD shall meet or exceed the following criteria:

2.15.1 For standard areas supply SPD having 100kA per phase surge current capacity. For mountain and desert areas (areas with over 5 lightning strikes per year), SPD shall have a per phase surge current capacity of 200kA.

2.15.2 UL 1449 – Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

2.15.3 SPD shall be UL labeled with 100kA Short Circuit Current Rating (SCCR).

2.16 UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

2.17 SPD shall be UL labeled with a minimum 100kVA short circuit rated (SCCR).

2.18 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

<u>System Voltage</u>	<u>Allowable System Voltage Fluctuation (%)</u>	<u>MCOV</u>
208Y/120	25%	150V
480Y/277	15%	320V

2.19 SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz. No filtering is required for a 100kA SPD.

2.20 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

2.21 Type 4 SPD shall include a serviceable, replaceable module.

2.22 SPD shall be equipped with the following diagnostics:

- 2.22.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
- 2.22.2 No other test equipment shall be required for SPD monitoring or testing before or after installation.
- 2.23 SPD shall have a response time no greater than 1/2 nanosecond
- 2.24 SPD shall have a 10 year warranty
- 2.25 The SPD panelboard shall have removable interior
- 2.26 The SPD panelboard main bus shall be aluminum and rated for the load current required
- 2.27 The SPD panelboard shall include a 200% rated neutral assembly with copper neutral bus
- 2.28 The unit shall be provided with a safety ground bus

(SPD) Quality Assurance

- 2.29 Manufacturer Qualifications: Engage a firm with at least 5 years experience in manufacturing transient voltage surge suppressors.
- 2.30 Manufacturer shall be ISO 9001 or 9002 certified.
- 2.31 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- 2.32 The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

PART 3 – EXECUTION

- 3.1 Painting of panelboard covers in finished areas shall be done by the general contractor.
- 3.2 Provide a spare 3/4" conduit stubbed to an accessible area for each of every three (3) spares or spaces provided in recessed panel boards.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.

Arc Flash and Shock Hazard

- 3.4 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.

- 3.4.1 **All studies shall be performed by “Emerson Electric” (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.**
- 3.5 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
- 3.6 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department
- 3.7 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.

END OF SECTION

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SECTION 26 27 26
SWITCHES AND RECEPTACLES

PART 1 – GENERAL

- 1.1 Furnish and install all wiring devices as shown on drawings and as herein specified. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable. Other acceptable manufacturers are Pass and Seymour, Leviton, General Electric and Bryant.
- 1.2 Submit manufacturers' data on all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not correctly indicating ampacity rating of proposed devices.
 - 1.3.2 Not including all items listed in the above itemized description.
 - 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 All switches shall be of the quiet mechanical type, Specification Grade, 20 amp, 120/277 volt AC as follows:

	<u>HUBBELL</u>	<u>LEVITON</u>	<u>PASS & SEYMOUR</u>
Single Pole	CS120	CS1202	CS20AC1
Two Pole	CS1222	CS2202	CSB20AC2
Three-way	CS320	CS3202	CS20AC3
Key Switch	HBL1221L	1221-2L	PS20AC1-L
- 2.2 All switches shall have the "on" and the "off" position indicated on the handle. If switches of higher ampere ratings are required, they shall be of similar type and quality as those shown above. Groups of switches shown at one location shall be installed under a single plate up to a maximum of six where more than six switches are shown coordinate arrangement with the Architect.
- 2.3 Dimmer switches for incandescent lamp loads shall be square-law type, slide control dimmer with OFF position, Lutron or Hubbell "Nova-T" Series NT-600 (0-500 watt load), NT-1000 (501-900 watt load), NT-1500 (901-1500 watt load), or equal (no known equal).

- 2.4 All convenience receptacles and special outlets throughout shall be grounding type. Convenience receptacles shall be side wired, parallel slot, two pole, three wire, 20 amp as follows:

	<u>HUBBELL</u>	<u>LEVITON</u>	<u>PASS & SEYMOUR</u>
Duplex	5352	5362	PS5362
GFCI	GFR5362	7899	2097
Isolated Ground	IG5362	5362IG	IG6300
Tamper Proof		8300SG	TR63H

- 2.5 All safety or tamper proof receptacles shall have no exposed external current carrying metal parts and shall have integral wiring leads suitable for two or three wire installations.
- 2.6 Special receptacles shall be as noted on the drawings.
- 2.7 Weatherproof plates shall be designed to meet CEC Article 410-57, wet location listed with cover "open." Where weatherproof receptacles have been identified to be provided with locking covers, the cover shall be as manufactured by Pass & Seymour #4600-8 or Cole Lighting 310 Series. Rough-in requirements vary between manufacturers. Contractor to field verify requirements prior to installation.
- 2.8 All plates throughout shall be stainless steel. Where wiring devices are installed in concrete block walls, provide oversized 3-1/2" x 5" coverplates.
- 2.9 All devices shall be white unless otherwise noted or a special purpose outlet.
- 2.10 Unless where specifically detailed on the drawings, floor boxes shall be PVC suitable for concrete poured floors of minimum 3-1/2" depth, with a modular design to gang two or three sections together.
- 2.10.1 Carlon #E976 series or approved equal
- 2.10.2 Provide brass cover with brass carpet flange unless otherwise detailed.

PART 3 – EXECUTION

- 3.1 Switches for room lighting shall be located no more than 12" center line from door jamb at plus 48" center line above finished floor or +46" to top of devices where located over casework, reference CBC Figure 11B-5D.
- 3.2 All receptacles shall be mounted at plus 18" to center line above finished floor unless noted or shown otherwise. All receptacles shall be installed with the ground pin up, at the top of the receptacle to comply with IEEE 602-1986.
- 3.3 Furnish and install wall plates for all wiring devices, and outlet boxes, including special outlets, sound, communication, signal, and telephone outlets, etc. as required. All cover plates shall be appropriate for type of device.

END OF SECTION

SECTION 26 27 27
OCCUPANCY SENSORS

PART 1 – GENERAL

- 1.1 Furnish and install occupancy sensor controls as shown on the drawings and as specified herein. The drawings indicate the type of occupancy sensor to be provided in each area. The manufacturer shall determine the quantity of sensors required for adequate coverage.
- 1.2 Submit manufacturer’s data on all items.
- 1.3 Occupancy sensor manufacturer shall provide 1/8" scale drawings indicating the required location and quantities for each room or area where sensors are indicated. Drawings shall be included with equipment submittal. Occupancy sensor manufacturer shall include as a part of the submittal wiring diagrams for Single sensor control of all room lights, no override switching, Single sensor control of all room lights, dual level override switching, Single sensor control of all room lights, three level override switching, and Single or multiple sensor control of all room lights, via switch pack, with or without override switching.
- 1.4 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.4.1 Not including all items listed in the above itemized description.
 - 1.4.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.4.3 Not including actual manufacturer’s catalog information of proposed products.
 - 1.4.4 Do not include multiple manufacturers for similar products and do not indicate “or approved equal” statements, or “to be determined later” statements. The products being submitted must be the products installed.

PART 2 - PRODUCTS

- 2.1 **Ceiling (Corner of the room)** sensors. Where ceilings are **less than** 11'-0" height, provide the following sensors mounted in the corner of the room:
 - Rooms **greater than** 25'-0" x 25'-0" = (2) □Hubbell□ # OMNI-DT-RP-1000
(2) □Watt Stopper□ # DT-200
(2) □Leviton□ # OSW12-M
 - Rooms **less than** 25'-0" x 25'-0" = (1) □Hubbell□ # OMNI-DT-RP-1000
(1) □Watt Stopper□ # DT-200
(1) □Leviton□ # OSW12

2.1.1 Provide each sensor with built-in light sensor and relay.

2.2 **Ceiling (Corner of the room)** sensors. Where ceilings are **greater than** 11'-0" height, provide the following sensors mounted on the wall at + 10'-0" in the corner of the room:

Rooms **greater than** 25'-0" x 25'-0" = (2) [Watt Stopper] # DT-200
(2) [Leviton] # OSW12-M

Rooms **less than** 25'-0" x 25'-0" = (1) [Watt Stopper] # DT-200
(1) [Leviton] # OSW12-M

2.2.1 Provide each sensor with built-in light sensor and relay.

2.3 **Ceiling** sensors. Where indicated on the drawings provide the following sensors mounted in ceiling:

Rooms **greater than** 25'-0" x 25'-0" = (2) [Hubbell] # OMNI-DT-RP-1000
(2) [Watt Stopper] # DT-300
(2) [Leviton] # OSC10-M

Rooms **less than** 25'-0" x 25'-0" = (1) [Hubbell] # OMNI-DT-RP-1000
(1) [Watt Stopper] # DT-300
(1) [Leviton] # OSC10-M

2.3.1 Provide each sensor with built-in light sensor and relay.

2.4 **Wall Mounted** sensors. Where indicated on the drawings, provide the following sensors mounted at +48" or maximum +46" where ADA access is limited:

Rooms **greater than** 25'-0" x 25'-0" = [Hubbell] # LP-1000
[Watt Stopper] # WS Series-300
[Leviton] # ODS15-ID

2.5 Alternate sensors as manufactured by [SensorSwitch], [Novitas] or any other manufacturers not listed above are **not** approved for use on this project.

2.6 The manufacturer shall provide additional switch pack units with each sensor as required for multilevel override switching in each room as shown on the drawings.

2.7 Exact Sensor locations in each room shall be field determined, per manufacturer's instructions.

2.8 Sensor quantities shall be provided in each area in order to activate room lighting with [step motion]. Where provided in classrooms, locate at the front and/or teacher's desk end of the classroom.

- 2.9 Sensors shall contain timing circuitry to provide user adjustable "time to light off" delay of 15 seconds to 15 minutes. Sensitivity controls shall be provided to give adjustable sensitivity settings from a range of 0-10 for each technology.
- 2.10 A manual override switch in the Sensor shall allow the load to be turned on without tools in the event of Sensor failure.
- 2.11 Sensors shall be suitable for Class 2 wiring.
- 2.12 An easily visible indicator light shall be provided to verify that motion is being detected. Provide separate indicator for ultrasonic and infrared sensor.
- 2.13 Sensors shall be designed, specifically, for the size and use of the area in which they will be used.
- 2.14 All Sensors shall be UL listed.
- 2.15 All Sensors which are ceiling mounted shall provide full coverage without gaps within the detection area.
- 2.16 Sensors shall be designed specifically for energy conservation, and shall be currently listed and approved by the California Energy Commission.
- 2.17 No automatic or inadvertent reduction in coverage shall occur when air-conditioning is in operation.
- 2.18 Sensors shall be able to be wired in parallel to allow coverage of large areas.
- 2.19 All ceiling sensors shall operate on 24 VDC derived from a switchpack unit which combines a transformer and relay, in a factory enclosure with wiring pigtails. Units which use separate field installed transformers and relays are not acceptable.
- 2.20 Switchpack units shall be UL listed.

PART 3 – EXECUTION

- 3.1 All equipment shall be installed per manufacturer's instructions.
- 3.2 All wiring shall be installed in conduit.
- 3.3 The Contractor shall program the switching system per the District requirement and demonstrate the performance of the system in the presence of the District representative.
- 3.4 The Contractor shall provide a minimum of four hours training for District personnel. After all initial programming has been completed and the system is fully functional, factory representatives shall be present to demonstrate reprogramming procedures.

- 3.5 All occupancy sensors shall be field set for maximum sensitivity and the time delay setting programmed for 15 minutes. The Contractor shall be required to field adjust sensitivities and time settings of sensors where their locations provide false activation. Each room shall be individually tested with a District representative to verify proper operation. Any areas which do not operate correctly shall have the sensor adjusted and/or relocated at no charge to the District, until satisfactory operation has been provided.

END OF SECTION

SECTION 26 28 16
DISCONNECTS

PART 1 – GENERAL

- 1.1 Furnish and install all disconnect switches as shown on the drawings and as required by the CEC.
- 1.2 Submit manufacturers' data for all disconnects and fuses.
 - 1.2.1 Disconnects
 - 1.2.2 Fuses
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Acceptable manufacturers shall be Square D, Cutler Hammer, Siemens or General Electric.
- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1 are not considered equal, or approved for use on this project.
- 2.3 All switches shall be heavy-duty type, externally operated, quick-make, quick-break, rated 600 volts or 240 volts as required, with the number of poles and ampacity as noted. All switches for motors shall be HP rated. Switches shall have NEMA-Type 1 enclosures, except switches located where exposed to outdoor conditions shall have NEMA Type 3R enclosure. Switches generally shall be fused except where noted to be non-fused on the drawings.
- 2.4 Where fuses are indicated, fuses shall be Bussman or Littlefuse (no known equal). Fuses shall be current limiting type with time delay characteristics to suit the equipment served.

PART 3 – EXECUTION

- 3.1 Mount all switches to structure or U-channel support. U-channel supports shall be cleaned and painted to prevent rust.
- 3.2 Switches shall be accessible with proper clearances in front per CEC 110-16.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.
- 3.4 Arc Flash and Shock Hazard
 - 3.4.1 The contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
 - 3.4.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
 - 3.4.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
 - 3.4.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed and in no case more than 8 cal./cm².

END OF SECTION

SECTION 26 33 23
EMERGENCY LIGHTING EQUIPMENT

PART 1 – GENERAL

- 1.1 Furnish and install an uninterruptible emergency lighting Inverter System and Emergency Power Control Relays to provide a reliable source of emergency power, designed to operate during periods of utility line deficiencies without any interruption in power supplied to the connected load. The system shall provide and be capable of powering any combination of electronic, power factor corrected, fluorescent, LED, incandescent or HID lighting. Other connected loads shall include but not be limited to building management systems, motors, security systems and other critical voltage or frequency-sensitive electronic loads. The system shall operate from 0-100% loading and be rated to deliver full KVA rated output at unity power factor for a minimum of 90 minutes. Upon return to normal AC utility line power, the system shall recharge the batteries without any interruption of power supplied to the load.
- 1.2 The Inverter System shall be listed to or comply with these standards:
 - 1.2.1 UL 924 Standard for Emergency Lighting and Power Equipment
- 1.3 The Emergency Power Control Relay shall comply with UL 924
- 1.4 Submit Manufacturers' data sheets for all components including:
 - 1.4.1 Warranty
 - 1.4.2 Wiring diagrams
 - 1.4.3 Bill of materials.
 - 1.4.4 Product catalog sheets or equipment brochures.
 - 1.4.5 Product guide specifications.
 - 1.4.6 Installation information, including weights and dimensions.
 - 1.4.7 Drawings for requested optional accessories.
- 1.5 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.5.1 Not including all items listed in the above itemized description.
 - 1.5.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.

- 1.5.3 Not including actual manufacturer's catalog information of proposed products.
- 1.5.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 - PRODUCTS

Single Phase systems 2000VA or less

- 2.1 The Central Inverter System specified herein shall be:
 - 2.1.1 Dual Lite "Synchron" Series Inverter System.
 - 2.1.2 Myers Power Products Illuminator "C-M" series
 - 2.1.3 Controlled Power Co. "UltraLite ELU" series
 - 2.1.4 Alternate manufacturers shall comply with these specifications and shall not exceed the physical dimensions and weights indicated on the drawing schedule.

Single Phase systems over 2000VA

- 2.2 The Central Inverter System specified herein shall be:
 - 2.2.1 Dual Lite "Spectron LSN" Series Inverter System.
 - 2.2.2 Myers Power Products Illuminator "E" series
 - 2.2.3 Controlled Ppwer Co. "UltaLite EON" series.
 - 2.2.4 Alternate manufacturers shall comply with these specifications and shall not exceed the physical dimensions and weights indicated on the drawing schedule.**
 - 2.2.5 Equipment as manufactured by Digital Signal Power Manufacturer (DSPM) has been reviewed and is not an approved alternate for this project.

Three Phase systems

- 2.3 The Central Inverter System specified herein shall be:
 - 2.3.1 High-Lites "H3FT" Series manufactured by Genlyte
 - 2.3.2 Myers Power Products Illuminator "CIII" series
 - 2.3.3 Alternate manufacturers shall comply with these specifications and shall not exceed the physical dimensions and weights indicated on the drawing schedule.**

- 2.3.4 Equipment as manufactured by Digital Signal Power Manufacturer (DSPM) has been reviewed and is not an approved alternate for this project.
- 2.4 System operation shall be fully automatic. The charging system will maintain the batteries at full capacity at all times. On-board microprocessors will continuously monitor charger settings and the system's overall readiness. Diagnostic circuitry shall include a software-controlled charger, continuous monitoring of operating parameters, and programmable system testing capabilities. Individual alarms and system logs shall be provided. All alarms and logs shall be automatically recorded and readily displayed via the User Interface Display (UID). The system shall also include one RS232 serial port for remote communications.
- 2.5 Automatic overload and short circuit protection in normal and emergency mode shall consist of 150% momentary surge capability, 120% overload for 5 minutes, and 110% overload for 10 minutes. Protection shall also include a low battery voltage disconnect, AC input circuit breaker, a DC input breaker or Fuse, and an AC output fuse. A digitally generated sinusoidal output waveform (PWM) with less than 5% total harmonic distortion at rated linear load shall be provided to the connected load.
- 2.6 Available input voltage shall be as indicated on the drawings, with a frequency of 60Hz. The AIC rating shall be a minimum of 42,000 RMS symmetrical amperes.
- 2.7 Available output voltage shall be as indicated on the drawings, with a frequency of 60Hz + 0.05Hz.
- 2.8 The user interface display (UID) shall include an array of LED's, a 2-line, 40-character LCD display, and a keypad for system input. The UID shall be menu-driven and display individual system parameters using a numbered code (Hot Key). The LED array shall indicate, by color code, the following status modes:
- 2.8.1 AC output presence (green)
 - 2.8.2 System ready (green)
 - 2.8.3 Battery charging (red)
 - 2.8.4 Inverter "ON" (amber)
 - 2.8.5 Alarm functions (red)
- 2.9 To ensure only authorized personnel have system access, a multi-level password shall be required to change all functions and operating parameters. A continuous scrolling display of the following metered functions shall be provided:
- 2.9.1 AC input voltage, AC output voltage, AC output amps
 - 2.9.2 Battery voltage, Battery charging amps, Battery discharge amps

- 2.9.3 Output volt-amps (VA), Output power (watts)
- 2.9.4 Ambient temperature
- 2.9.5 Last inverter run time, Total inverter run time, System run time, Date Time
- 2.10 Audible and visual alarms shall be provided, with automatic logging of the twenty-five most recent events. An alarm acknowledgment feature shall be provided, which will allow the user to silence only the current audible alarm without silencing other alarms or clearing the alarm condition until the fault has been addressed. An alarm shall be sounded if any of the following operating conditions occur:
 - 2.10.1 Low battery voltage, Near low battery voltage, High battery voltage
 - 2.10.2 High AC input voltage, High AC output voltage, Low AC output voltage Output, overload (VA), Low remaining run time
 - 2.10.3 High ambient temperature
 - 2.10.4 Tripped circuit breaker
- 2.11 Manual and automatic test modes shall be provided.
 - 2.11.1 Manual user-initiated system test at any time.
 - 2.11.2 Automatic monthly and annual self-diagnostic tests.
 - 2.11.3 Automatic recording of the last twenty events in a Test Results log.
- 2.12 A three-step float charger shall be software controlled and temperatures compensated, and charge the batteries continuously while in normal “standby” condition (non emergency mode). Following a power failure, the constant current charger mode shall be initiated until battery voltage reaches the equalize stage. Equalize stage shall be maintained until the charging current drops to .5 amps, or 0.3% of the battery amp/hour rating. Battery voltage shall then enter the float stage.
- 2.13 Batteries shall be designed to provide a minimum 1.5 hours rated output voltage to the connected load in emergency mode without dropping below 87.5% of nominal battery voltage.
 - 2.13.1 The batteries shall be encased in an enclosure that permits easy maintenance without requiring removal.
 - 2.13.2 Sealed Lead Calcium: Maintenance Free Construction requires no addition of water over its useful. Life expectancy is 10-years at 77F (25C) ambient temperature.
- 2.14 The following optional factory-installed equipment shall be provided:

2.14.1 Normally-On Output Circuit Breaker Options:

2.14.1.1 A maximum of fourteen monitored positions are available. Single pole 120V and 277V breakers occupy one position each, while double pole 240V breakers occupy two positions. Reference drawings for required number of output breakers required.

2.14.2 Provide Universal cabinet locks for all electronic and battery cabinets.

2.14.3 Provide, using the system's RS232 port, a fax operating status reports is transmitted over a customer-supplied dedicated analog phone line to up to six locations. Phone numbers can be programmed locally using the unit keypad or computer terminal, or remotely via a modem. Each designated fax location automatically receives a unit status report following monthly and annual tests, or when an alarm condition is detected. Status reports include readings on key operating parameters, as well as complete alarm and inverter log printouts, in uncoded, user-friendly descriptions. This option also provides for two-way communications thru terminal emulation software, such as HyperTerminal (not supplied with the inverter system).

2.14.4 Provide a factory-installed, internally-mounted two-position "make before break" switch. Compatible with all input/output combinations and any combination or quantity of output circuit breakers. Allows connecting the utility power supply to the load without placing the inverter in emergency mode.

2.15 Maintenance, Service and Enhanced Warranty Plans. The following shall be provided to assure initial and long-term viability of the system through additional maintenance and service plans and/or through enhancements to the standard two-year electronics limited warranty.

2.15.1 Factory Start-Up shall be supplied as a service to the installing contractor. The Factory Start-Up process shall verify correct installation and operation of the inverter system. Trained, factory authorized technicians shall administer an on-site, point-by-point check of the system to include:

2.15.1.1 Internal electrical connections

2.15.1.2 AC input and Battery connections

2.15.1.3 System operating voltages

2.15.1.4 System operating parameters

2.15.1.5 Initial system "power-up

2.15.1.6 Battery discharge test

2.15.1.7 Correction of existing deficiencies

2.15.1.8 Final testing, calibration and recording

2.15.1.9 Training of available operating personnel

2.15.2 A Monitoring Program shall provide for the continuous monitoring of the inverter system by the Factory Technical Support Group. All monthly and annual system tests shall be reviewed and analyzed for early warning signs of system malfunction. Any failures shall be automatically relayed to the service department where corrective action can be recommended to the owner/operator. For activation, a user supplied dedicated analog phone line must be available.

2.15.3 Preventive Maintenance Plan (PMP) - The Preventive Maintenance Plan shall provide system coverage beyond the standard two-year factory warranty. PMP warranty service excludes the batteries, which are covered under a separate warranty plan. Installation of a Fax Modem option shall be provided for Preventive Maintenance Plan.

2.15.3.1 Additional 2-year warranty and 2-year service coverage, weekdays, Monday-Friday, 8AM to 5PM EST. If the standard factory warranty has expired before selection and purchase of a PMP plan, an on-site evaluation shall be scheduled to determine if the system requires parts and/or labor to return to factory specifications. Parts and labor required shall be charged at additional costs.

2.16 The system shall be contained in a code gauge, steel NEMA 1 enclosure, finished in a scratch resistant, powder coat finish, with a key lock, conduit knockouts at the top and sides, and front opening doors. Enclosures shall be designed to allow stacking to minimize the overall system's footprint. All components shall be front accessible and incorporate a modular design and a quick disconnect means to facilitate servicing.

Emergency Power Control Relays - (Noted on the drawings as LVS EPC Control relay)

2.17 Insert Series power control modules are designed to allow locally switched lighting fixtures to be wired for emergency operation from either generator, inverter system, or secondary sources.

2.18 As Manufactured by:

2.18.1 "Highlights" HEPC Series Emergency Power Control modules (203) 575-2044 www.highliteslighting.com or approved equal.

2.18.2 LVS Controls (800) 982-4587 www.lvscontrols.com.

2.19 During normal operation, LEDs on the module's faceplate indicate the presence of both utility (Green) and emergency (red) power and the local switch will be capable of turning all circuit lighting fixtures on or off as required. During utility power failures, emergency lighting fixtures controlled by the module will illuminate regardless of local

switch position. If, during normal operation, emergency backup power is lost, the module will automatically produce an audible alarm as an alert to this potentially hazardous condition.

- 2.20 Recent energy mandates require improved vigilance in the conservation of resources. By eliminating the need for night light circuits, power controls conserve energy by allowing all area ambient lighting to be turned off while still assuring the availability of emergency illumination in the event of a utility power failure.
- 2.21 The power control automatically initiates a test of the emergency lighting fixtures whenever the local switch is turned off. Upon turning off of the local switch, the designated emergency lighting fixtures will remain illuminated for an additional 5 seconds to assure system readiness. The power controls may also be checked manually at any time through the integral test switch provided on the module's faceplate. With the local lighting turned off and both utility and emergency power present, pressing the test switch will cause the controlled emergency fixtures to illuminate for 5 seconds.
- 2.22 Adapts locally switched lighting fixtures for emergency operation, bypasses local switch during power failures. Compatible with motion detector and photocells.
- 2.23 Full 20 amp load capability available for 120 or 277VAC operation. Approved for in-wall or in-ceiling applications.
- 2.24 Provided with Surge and short circuit protection.
- 2.25 Audible emergency power circuit failure alarm, Built-in manual emergency circuit test feature, Momentary test switch.
- 2.26 Provide a single module at each emergency lighting fixture where the lighting fixture is locally controlled by a room switch and or motion sensor. These modules are to be furnished and installed by the contractor installing the lighting fixtures.
- 2.27 Provide a single module located at the panelboard or low voltage control panel to control emergency lights controlled from a low voltage control system. These modules are to be furnished and installed by the contractor installing the lighting fixtures.
- 2.28 Where dimmable light fixtures are on emergency circuit, provide emergency relay control, which is dimming compatible, and will bring lights to full brightness in emergency mode.
- 2.29 The Module has a full 5-year replacement warranty.

PART 3 - EXECUTION

- 3.1 Input and output conductors shall be enclosed in separate conduits. All load side wiring shall be sized as required for voltage drop conditions to assure proper operation of connected loads.

- 3.2 All free-standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1632A and Table 16-A0. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.
- 3.3 The system shall allow connection of both “normally on” and “normally off” (optional) loads. Connected loads shall receive utility power during normal operation, and ‘no break” system inverter power during utility interruptions.
- 3.4 In emergency mode, the inverter system shall supply true digitally-generated AC sinusoidal output. Refer to plans for type and location of loads served by the system.
- 3.5 A factory trained service representative shall be dispatched to perform the initial system start-up.
- 3.6 Documents supplied with each system shall include:
- 3.7 Shop drawings showing physical dimensions, mounting information and wiring diagrams.
 - 3.7.1 Installation/Users manual(s) for locating, mounting, interconnecting, and wiring the system, with operating and preventive maintenance procedures.
 - 3.7.2 The system shall be installed in accordance with all appropriate manufacturers’ instructions and in compliance with all appropriate codes.
- 3.8 The system shall be guaranteed, under normal and proper use, against defects in workmanship and materials for a period of two years from the date of shipment. Batteries supplied as part of the systems shall be covered under a separate pro-rata warranty as described below:
 - 3.8.1 Sealed Lead Calcium, 10-year life expectancy – One-year full replacement warranty plus an additional nine years pro-rata.
 - 3.8.1.1 Note: Within 90days from date of shipment, batteries shall be connected to an energized charging system to maintain the Warranty. Battery life and capacity is rated at an optimum operating temperature range of 68F to 85F. Operating temperatures outside this range will affect battery life and capacity. Batteries are rated at 100% capacity at 77F.
- 3.9 Maintenance and service programs shall be made available by the supplier to assure long-term reliability of the system.

END OF SECTION

SECTION 26 51 14
LED LIGHTING FIXTURES AND LAMPS

PART 1 – GENERAL

- 1.1 Furnish and install all lighting fixtures with lamps as specified and as shown on the drawings. Fixtures shall be complete including canopies, hanger, diffusers, ballasts, etc.
- 1.2 Submit manufacturer's data for each fixture type including the following:
 - 1.2.1 Lighting fixture catalog data and photometry.
 - 1.2.2 Lamp catalog data for each fixture type.
 - 1.2.3 Driver catalog data for each fixture type.
 - 1.2.4 Fixture warranty.
- 1.3 **Common submittal mistakes which will result in the submittal being rejected:**
 - 1.3.1 Not including lamp and driver information for each fixture type.
 - 1.3.2 Not including all items listed in the above itemized description.
 - 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PRODUCT SUBSTITUTION

- 1.4 All substitutions or alternate fixtures to those indicated on the project fixture schedule shall be submitted for approval (7) business days prior to the project bid date. Approvals when accepted will be issued in the form of an addendum. No consideration for substitutions will be provided after the award of the contract.
 - 1.4.1 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price. The substitution request must include a comparison of the total fixture wattage, total fixture lumens, fixture efficiency and warranty comparison.
 - 1.4.2 When proposing to substitute lighting fixture and/or fixture retrofit, a point by point photometric calculation of a typical application as used in this project shall be included. A calculation of the specified and the proposed alternate shall be included.

PART 2 – PRODUCTS

- 2.1 All catalog numbers are given for manufacturer's identification and shall not relieve Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the Specifications and matches specified ceiling.
- 2.2 All fixtures of the same type shall be of one manufacturer and of identical finish and appearance. All fixtures and component parts shall bear the UL label.
- 2.3 All steel parts shall be phosphate treated in multistage power spray system for corrosion resistance and paint adhesion. Final finish shall be electrostatically applied baked white enamel of not less than 87 pct. reflectance on reflecting surfaces.
- 2.4 Each fixture shall have a continuous light-seal gasket seated in such manner as to prevent any light leak through any portion or around any edge of the trim frame.
- 2.5 Diffusers shall be framed in a hinged, continuous assembly. Diffuser frame latches shall be spring-loaded or cam-operated.
- 2.6 All recessed fixtures shall be provided with frames appropriate for the type of ceiling involved. No fixtures shall be ordered until the ceiling construction has been verified by the Contractor.

MINIMUM LUMINARY REQUIREMENTS

- 2.7 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.
- 2.8 Recessed Fixtures: Comply with NEMA LE 4.
- 2.9 CRI of **minimum 80 CCT of 4100 K.**
- 2.10 Rated lamp life of 50,000 hours minimum.
- 2.11 Lamps dimmable from 100 percent to 0 percent of maximum light output.
- 2.12 Nominal Operating Voltage: **120 V / 277 V ac**

PART 3 – EXECUTION

- 3.1 All lighting fixtures shall be supported as follows:
 - 3.1.1 From the outlet box by means of a metal strap where its weight is less than five pounds.

- 3.1.2 From its outlet box by means of a hickey or other threaded connection where its weight is from five to fifty pounds.
- 3.1.3 Directly from the structural slab or joists where its weight exceeds fifty pounds.
- 3.1.4 Lighting fixtures shall be supported independent of the ceiling system or additional ceiling support must be added to carry the weight of the lighting fixtures. Recessed lighting fixtures supported from ceiling grid tees shall be furnished with hold down clips in conformance with CEC 410 - 16, spring clips will not be permitted. All fixtures which the manufacturer has not provided UL approved clips, must be attached to the fixture and ceiling grid by metal screws.
- 3.2 Furnish and install supplementary blocking and support as required to support fixture from structural members. Contractor shall submit proposed blocking method for all suspended lighting fixtures for approval prior to rough in.
- 3.3 Suspended and/or pendant mounted fixtures shall be provided with four aircraft safety cables extending in opposite directions, attached to the fixture, and supported from a structural member. The contractor shall submit proposed fixture mounting and aircraft cable attachment methods for approval prior to fixture rough in.
- 3.4 Class 1 wiring to the fixture must be installed either conduit or type MC-PCS cabling no open wiring shall be permitted.
- 3.5 Chain suspension may be used only where specifically permitted on the drawings. Chain shall be heavy duty, nickel or cadmium plated, suitable for weight of specific fixture.
- 3.6 Shop drawings shall be furnished for each fixture type. Catalog cuts, illustrating conformance with specifications, will be acceptable for standard units. Shop drawings shall indicate materials, assembly, finish and dimensions.
- 3.7 Photometric data shall be furnished for any fixture substituted for those listed on the schedule.
- 3.8 Any driver which produces a greater than normal amount of noise shall be replaced by the contractor. Normal will be determined by the level of sound produced by other similar fixtures operating in the area.

END OF SECTION

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SECTION 26 90 90

TESTING

PART 1 – GENERAL

- 1.1 Upon completion of the electrical work, the entire installation shall be tested by the Contractor, and demonstrated to be operating satisfactorily to the Architect, Engineer, Inspector and Owner.
- 1.2 All testing and corrections shall be made prior to demonstration of operation to the Architect, Engineer, Inspector and Owner.
- 1.3 In addition to the demonstration of operation, the Contractor is also required to review the content and quality of instructions provided on items demonstrated with the Architect, Engineer, Inspector and Owner.

PART 2 – EXECUTION

- 2.1 Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from “grounds,” “short circuits,” and any or all defects.
- 2.2 Motors shall be operating in proper rotations, and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed, and all other electrical equipment for proper operation.
- 2.3 Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.
- 2.4 All equipment or wiring provided which tests prove to be defective or operating improperly shall be corrected or replaced promptly, at no additional cost to the Owner.
- 2.5 Test all motor and feeder circuits with a “megger” tester to determine that insulation values conform to Section 110-20, California Electrical Code (CED). Test reports must be submitted and approved by the engineer before final acceptance.
- 2.6 Test all grounding electrode connections to assure a resistance of no more than 10 ohms is achieved. Augment grounding until the ohmic value stated above is achieved. Provide certified test results to the Architect, Engineer and Inspector.

END OF SECTION

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SECTION 27 01 00
COMMUNICATIONS GENERAL PROVISIONS

ARTICLE 1 - SUMMARY

- 1.1 This Division of the specifications outlines the provisions of the contract work to be performed as a sub contract under the Division 26 scope of work. Reference the Division 26 Electrical General Provisions for scope of work and general requirements.

- 1.2 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under Division 1 requirements.

END OF SECTION

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SECTION 27 10 00
VOICE / DATA / IP INTERCOM-CLOCK INFRASTRUCTURE

PART 1 – GENERAL

- 1.1 Include all labor, equipment and materials necessary for providing a complete networking infrastructure system as described herein and/or as indicated on the drawings.
- 1.2 Related specification sections:
 - 1.2.1 Section 26 01 00 - General Provisions
 - 1.2.2 Section 26 05 33 - Conduit and Fittings
 - 1.2.3 Section 26 05 19 - Conductors
 - 1.2.4 Section 26 05 34 – Outlet and Junction Boxes
- 1.3 Approved Products and minimum contractor certifications
 - 1.3.1 All components shall be manufactured by one of approved manufacturers, the installing contractor must have the accompanying certification from the product manufacturer for installation of a “Warranted System” as required by each manufacturer and as indicated in these specifications. **Acceptable manufacturers are:**
 - 1.3.2 **Commscope**
 - 1.3.2.1 Installing contractor must be **Commscope** certified to install this system
 - 1.3.2.2 **Installing Contractor must be PartnerPro certified to install any of the systems under the Commscope Family of brand names**
 - 1.3.2.3 **The Infrastructure System shall be provided with a 25-Year Warranty**
 - 1.3.2.4 **Pursuant to Public Contract Code Section 3400(b), the materials, products, things or services in this Specifications section are designated by specific brand name or trade name for the purposes of matching other products in existing District projects to establish District-wide uniform, complete and compatible systems in order to facilitate the most technologically competitive and feasible education for school**

children in the District. A copy of the District findings and Resolution in accordance with Public Contract Code Section 3400(b) is available upon written request at the District.

- 1.3.3 Systems or components as manufactured by any other manufacturers which, are not specifically listed in 1.3.2 are not approved for use on this project. Specified system warranties are to be established between the component manufacturers and the owner, warranties between the cable manufacturer or installing contractor and the owner are not considered equal.
 - 1.3.4 Installing contractor qualifications: Firms and their personnel must be regularly engaged in the installation of data networking cabling and equipment for systems of similar type and scope. The contractor must have a full service office able to respond to emergency callouts during the warranty period. The contractor must also provide complete installation of all wiring and devices or equipment. Subcontracts with electrical contractors or other warranted or non-warranted contractors for supervised installation of any part of this system are not approved. All conduit and standard back boxes will be furnished and installed by the electrical contractor. Specialty boxes will be furnished by the equipment supplier and installed by the electrical contractor.
 - 1.3.5 Equipment qualifications: It is the intent of these specifications that each bidder provides all hardware, components and installation services that are necessary to ensure a fully operational Category-6 wiring system including warranties, proposed in the EIA/TIA Category-6 and the ISO Class E drafts.
 - 1.3.6 **Warranty: Warranty shall be a full "Performance Warranty" installed by a "Certified Contractor" as specified by one of the approved manufacturer's A "Component Warranty" will not be considered equal.** All components, labor, and 'Link Performance Criteria" shall be warranted by one of the approved manufacturers. Warranty shall be to the customer for 25-years (some warranty programs may be greater, this is a minimum requirement) after Customer acceptance and sign-off of the completed system. **The contractor must provide documentation from one of the approved manufacturers as indicated in Section 1.3.2 indicating their qualifications for installation of this system in compliance with the manufacturers warranty requirements as a warranted contractor.**
- 1.4 In order to ensure project cohesion, a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all labor; cabling; equipment; supplies; materials, and training. The Contractor will perform all operations necessary for the "TURNKEY" and fully completed installation in accordance with the specifications herein. As such, the successful

contractor must be factory trained on all aspects of system hardware. The successful Contractor shall be a California licensed C7 or C10 premise wiring contractor as defined in this specification. Subcontractors may not be utilized in the implementation of the plant wiring installation or certification process. The contractor shall provide a licensed, qualified electrical contractor for installation of all conduits, outlet and junction boxes, trenching and pull box installations.

1.5 The drawings indicate a schematic routing of cables above ceilings. The Contractor shall field-verify the most appropriate routing of all above-ceiling cable prior to bid. Where cables penetrate through walls a conduit sleeve shall be provided. **Where cables pass through fire rated walls, the conduit sleeve shall be sealed to maintain the rating of the wall assembly.**

1.6 General Submittal Requirements

1.6.1 **Phase I Submittal** shall be made in electronic format within (20) working days after the award of the contract by the District. This submittal shall include the following:

1.6.1.1 Complete Bill of Materials in Excel Spreadsheet format with bills of quantities, including all materials, components, devices, and equipment required for the work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each Section listed:

1.6.1.2 Description and quantity of each product.

1.6.1.3 Manufacturer's Name and Model Number.

1.6.1.4 Manufacturer's Specification Sheet or Cut Sheet. Material Cut Sheets shall provide detailed product information and shall be original manufacturer product bulletins. Copies of material information from vendor websites shall not be considered equal and will not be excepted.

1.6.1.5 Material Cut Sheet part number provided shall be highlighted or provided with an arrow directed at the corresponding part number.

1.6.1.6 Specification Item Number referenced for each required product or if not shown in the specifications, Drawing Detail Number being referenced. (ie; Spec. 271000 Item 2.1 or DWG E4.15/#1)

1.6.1.7 Include with submittals all warranty information and a description of support and maintenance services to be

provided. Also include all licenses and maintenance agreements required for continued operation of the equipment.

1.6.2 **Phase II Submittal** shall be provided with (20) working days after the approval of the Phase I submittals and prior to any fabrication of field conduit installations. All shop drawings shall be engineered in a CAD Software. Submission shall include electronic print copies to match the contract drawings, and Phase II submittals drawings shall include the following:

1.6.2.1 MDF and IDF equipment rack or cabinet elevations will be required to be provided including cable routing, grounding, support, UPS, network electronics, etc. and position of all components in the rack or cabinet.

1.6.2.2 Provide labeling plan which identifies the proposed scheme for identifying all components including racks, patch panels (fiber and copper), site distribution feed cables, horizontal station cables and site conduit systems (handholes, pullboxes, etc.).

1.6.2.3 Provide shop drawings showing all end device locations, tap values, paging zones and amplifier sizing for each zone for analog speakers and horns, including devices connected to IP-Based zone controllers.

1.6.3 **Common submittal mistakes** which will result in submittals being rejected:

1.6.3.1 Not including the qualifications of the installing contractor.

1.6.3.2 Not including all items listed in the above itemized description.

1.6.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.6.3.4 Not including actual manufacturer's catalog information of proposed products.

1.6.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

1.6.4 **Common submittal mistakes** which will result in submittals being rejected:

- 1.6.4.1 Not including the qualifications of the installing Contractor Company and Contractor's Staff.
- 1.6.4.2 Not including all items listed in the above itemized description.
- 1.6.4.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlights, underlining or clouding the items to be reviewed (provided for the project) or crossing out the items which are not applicable.
- 1.6.4.4 Not including actual manufacturer's cut sheets or catalog information of proposed products.
- 1.6.4.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.
- 1.6.4.6 The Contractor shall make a written request directly to Johnson Consulting Engineers for electronic drawing files (CAD). As a part of the written request, please include the following information:
- 1.6.4.7 Clearly indicate Project Name and Client, Johnson Consulting Job Number (located in the bottom left corner of JCE Engineering Stamp) and each drawing Sheet Number required (i.e. E1.1, E2.1, E4.1 etc.)
- 1.6.4.8 Identify the Name, Company, Title, phone number, mailing address and e-mail address of the person to receive the files.
- 1.6.4.9 Detail or Riser diagram sheet, System Schematic drawings or any other drawings other than floor plans or site plans, will not be made available to the Contractor.
- 1.6.4.10 Files will only be provided in the AutoCAD format in which they were created (i.e. version 2015 or version 2016). Files will not be made available in REVIT format.
- 1.6.4.11 Requests for files will be processed as soon as possible; a minimum of (7) working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use and delays in requesting files will not alleviate the Contractor from submitting required documents within the required timeline.

PART 2 - PRODUCTS

- 2.1 Equipment racks have been detailed on the drawings and additional component information requirements have been described in the MDF or IDF products sections. The following is a list of approved manufacturers for each type of rack system.
- 2.1.1 Alternate equipment manufacturers other than those indicated will not be reviewed or approved for use on this project.
- 2.1.2 (Open Frame) shall be manufactured by Chatsworth Products Inc. (CPI). CPI Model #50120-703 Quadrarack 4-Post equipment rack, 84" High by 29" Deep, black color. See MDF and IDF Room sketches for quantity of racks required.
- 2.2 Open Frame 4-Post Racks, 19" mounting Width by 84" High by 29" Deep with #12-24 mounting holes as shown in the MDF of IDF Room layouts. Contractor shall be responsible for providing all racks and accessories. Furnish and install with the following:
- 2.2.1 The racks shall be provided with structural seismic bracing using cable runway to the top of the rack.
- 2.2.2 Universal 12" cable runway shall be as manufactured by CPI Model 10250-712. The cable runway shall be furnished with the additional adapters, connectors, support components, bends and offsets and extensions as required to fit the room and layout.
- 2.2.3 Anchor the cable runway to the wall with the appropriate width angle bracket and bolts as manufactured by CPI Model #11421-712.
- 2.2.4 The cable runway shall also be attached to the top of the rack with the appropriate adapter panel. Cable runway shall be directly attached to the 4-Post racks with J-Hooks.
- 2.2.5 Cable runway routed along walls, shall be offset from the wall a minimum of 6" and shall be supported with cantilevered wall mount brackets.
- 2.2.6 Floor mounted racks shall be structurally anchored to the floor with the anchors and bolts.
- 2.2.7 Provide full length vertical wire managers, CPI Double-Sided Narrow Vertical Manager, Part #12096-703, on each side of each rack. Vertical managers between racks may be substituted with the CPI #11729-703 6" wide double-sided manager. Single narrow vertical managers shall be provided on each end of the group of racks.

- 2.2.8 Provide (1) adjustable full depth vented shelf for each 4-Post equipment rack as manufactured by CPI #12700-719.
- 2.2.9 Provide horizontal wire managers between each patch panel or (1) manager per patch panel. Provide (1) spare manager per rack. Provide 2RMU height managers for each 48-Port patch panel and 1RMU height managers for 24-Port patch panels. CPI part #30130-719 and #30139-719.
- 2.2.10 Rack mounted surge arrest style power distribution units (PDU) shall be Contractor College District furnished and Contractor installed. Coordinate with the District for the final locations of the PDUs in the racks and the type to be provided.
- 2.2.11 Provide One or Two Rack-Mounted Power Distribution Units per equipment rack as shown on the Detail Drawings. Rack mounted surge-arrest style Power Distribution Unit (PDU), 1RU (Rack Unit) in height, TrippLite Model #PDUMH15NET2 with (8) NEMA 5-15R outlets, built-in SNMP Ethernet interface and NEMA L5-15P input with 5-20P adapter or approved equal by APC. Provide with minimum 10-foot cord for the PDU.
- 2.2.12 Contractor shall be responsible for neatly routing, storing and connecting the power cords from the PDUs to the electrical outlet or UPS as directed by the District. Power cords shall be dressed separately from the UTP cables or any other low voltage cable and shall be secured to the back of the rack or cable runway with Velcro ties.
- 2.2.13 Contractor shall be responsible for neatly routing, storing and connecting the power cords from the PDUs to the electrical outlet or UPS as directed by the District. Power cords shall be dressed separately from the UTP cables or any other low voltage cable and shall be secured to the back of the rack or cable runway with Velcro ties.
- 2.2.14 Furnish grounding to each rack. Each rack shall be provided with a grounding terminal block, #6 Ground wire from the rack to the bus bar and a compression lug on the end of the ground wire at the bus bar. Provide grounding components as manufactured by CPI #40167-001 terminal block and #40162-901 compression lug or approved equal.
- 2.2.15 Provide (1) ground bus bar kit per MDF Room. Ground Bus Bar Kit as manufactured by CPI #40158-012 or approved equal. Ground Bus Bar and all bonding conductors to the bus bar shall be labeled. Grounding conductors shall be routed to the equipment racks, cable runway and electrical panel

Main Distribution Frame (Existing MPR Building)

2.3 The main Distribution Frame (MDF) Room is existing

- 2.4 Provide Fiber Optic Feed Cable Patch Panels – Fiber optic termination equipment (rack mounted), including all associated installation hardware. The equipment must have a sufficient number of ports to connect all fibers in every cable terminated at this location. Provide 25% spare capacity for future wiring requirements, including bulkheads in the fiber patch panel. Provide blank fillers for all used portions of the panel. All fiber feed cables shall be terminated in a single fiber optic patch panel up to 144 strands. Additional strands shall be terminated in the largest size required to continue the remaining fibers.
- 2.4.1 Contractor shall provide a minimum of 6-feet of slack on the fiber feed cable in the fiber optic patch panel. The first 48” of a tight buffered cable or the first 24” of a loose tube cable shall not be stripped back in the patch panel. Each type of cable shall have a minimum of 24” of stripped slack within the patch panel. Total slack within the patch panel shall not be less than 6-feet in length.
- 2.4.2 All fiber cables shall be secured to the patch panel with the Kevlar strength members at the manufacturer provided anchor point at the rear of the panel.
- 2.4.3 All fiber optic feed cables routed to the MDF Room shall be provided with 20-feet of slack for a service loop mounted on the backboard behind the existing racks. Contractor shall provide a 24” diameter wall mounted service loop manager for the fiber optic feed cables as manufactured by Leviton #48900-FR
- 2.4.4 Provide all other items as detailed on the drawings.

Intermediate Distribution Frame

- 2.5 The Intermediate Distribution Frame shall be a secondary wiring and equipment location for the data networking system. The contractor shall include the following items at this location.
- 2.5.1 Provide backboard 8’-0” high x ¾” thick, with a minimum 48” width. Refer to the floorplans for the actual layout of the backboard coverage. Plywood mounting backboard shall be flame resistant, painted with fire resistant paint “white” or color to match the room finish. Contractor shall provide minimum one side finish grade plywood. Backboard shall be mounted with finish side out, regardless of location of fire rating stamp. Show proof of fire rating stamp to IOR on Inspector prior to installation.
- 2.6 Provide Fiber Optic Feed Cable Patch Panels – Fiber optic termination equipment (rack mounted), including all associated installation hardware. The equipment must have a sufficient number of ports to connect all fibers in every cable terminated at this location. Provide 25% spare capacity for future wiring requirements. Provide blank fillers

for all used portions of the panel. All fiber feed cables shall be terminated in a single fiber optic patch panel.

- 2.6.1 Each IDF location shall be furnished with a minimum 24-Port patch panel, fully loaded with bulkheads. Type of connectors in the bulkheads shall be determined by the type of connectors used for termination of the fiber feed cables.
 - 2.6.2 Contractor shall provide a minimum of 6-feet of slack on the fiber feed cable in the fiber optic patch panel. The first 48" of a tight buffered cable or the first 24" of a loose tube cable shall not be stripped back in the patch panel. Each type of cable shall have a minimum of 24" of stripped slack within the patch panel. Total slack within the patch panel shall not be less than 6-feet in length.
 - 2.6.3 All fiber cables shall be secured to the patch panel with Kevlar strength members at the manufacturer provided anchor point at the rear of the panel.
 - 2.6.4 All fiber optic feed cables routed to the IDF Room shall be provided with 20-feet of slack for a service loop mounted on the backboard behind the rack. Contractor shall provide a 24" diameter wall mounted service loop manager for the fiber optic feed cables as manufactured by Leviton #48900-FR.
- 2.7 Provide Category-6 Modular Patch Panels (rack mounted) with RJ45 style connectors, for terminating all new twisted pair cable from each Voice, Data, IP-Page Speaker/Horn and Audio-Visual System outlet served from this location. All UTP patch panels shall be 48-port Fully-Loaded minimum. Confirm colors with IT Department prior to ordering. Provide cable support bars at the rear of each patch panel all cables shall be secured to bars with velcro straps.
- 2.8 Provide all other items as detailed on the drawings.

Fiber Optic Patch Cords

- 2.9 Fiber optic patch cords shall be furnished and installed by the Contractor.
- 2.10 All fiber optic patch cords furnished by the Contractor shall match the grade and glass of the fiber optic feed cable installed for the network infrastructure cabling system. The Contractor shall confirm with the District IT Department the type of connector required at the network equipment prior to ordering or installing the patch cords.
- 2.11 Multimode Fiber Optic Patch Cords - Patch cords shall be duplex 50/125um, (OM4) Laser-optimized grade Multimode optical glass. Fiber optic patch cords shall be furnished with "SC"-Type connectors at the Fiber Patch Panel end and "LC"-type connectors at the Network Switch end. All Multimode patch cords shall be Aqua in color.

Patch cords shall be 6-feet (2-meters) in length. Provide Four (4) 3-Meter (Approx. 9.5 Feet) Multimode Fiber Optic Patch Cords for the existing fiber optic feed cable from the Building '200' MDF Room to the existing Building 1600 (Kitchen/Cafeteria) IDF Cabinet, Two (2) for each end of the cable run.

- 2.12 Contractor shall be responsible for confirming the network switch connections with the District IT Director prior to ordering or installing the patch cords.

Copper Patch Cables

- 2.13 Copper Patch cables shall be furnished and installed by the Contractor.
- 2.14 Provide Patch Cables at the equipment rack location in the following colors related to the function of the data drop.
 - 2.14.1 Color; Blue (Data)
 - 2.14.2 Color; Gray (AV/Projector)
 - 2.14.3 Color; White (Phone/Voice Trunk)
 - 2.14.4 Color; Yellow (IP Speakers/Speaker-Clock Combination)
 - 2.14.5 Color; Orange (Wireless Access Point)
 - 2.14.6 Color; Red (Video Surveillance Camera)
- 2.15 Patch cords shall be in compliance with the manufacturer's "Channel" warranty requirements
- 2.16 Provide (Color as Shown) Category-6 (Patch Panel End) Patch Cables with pre-molded boot, provide quantity equal to:
 - 2.16.1 Provide quantity equal to 50% of the total Voice/Data Infrastructure cable drops or ports provided. Allow for 15% of total copper Patch Cables required to be (7) feet in length, and all remaining Patch Cables shall be (4) feet in length.
 - 2.16.2 Provide (color per detail drawings and station insert color) Category-6 (patch panel end) Patch Cables with pre-molded boot, provide quantity equal to 100% of the total IP Clock/Speakers, Wireless Access Points, LCD Projector/Audio-Visual and IP camera cable drops or ports provided. Verify with Customer all ports which will be activated. All Patch Cables to be installed by Contractor. All Patch Cables shall be (4) feet in length, unless otherwise shown in the drawings or specifications.

- 2.17 Provide Category-6 (Workstation End) Patch Cables with pre-molded boot, provide quantity equal to:
- 2.17.1 Provide quantity equal to 50% of the total Voice/Data Infrastructure cable drops or ports provided. Provide for 10% of total copper patch cords required to be (15) feet in length and all remaining Patch Cables shall be (10) feet in length.
 - 2.17.2 Provide (color per detail drawings and station insert color) Category-6 (Device Location end) Patch Cables with pre-molded boot, provide quantity equal to 100% of the total IP Clock/Speakers, Wireless Access Points, LCD Projector/Audio-Visual and IP camera cable drops or ports provided. Verify with Customer all ports which will be activated. All Patch Cables to be installed by Contractor. All Patch Cables shall be (2) feet in length, unless otherwise shown in the drawings or specifications.
- 2.18 Requirements for all copper patch cords furnished:
- 2.18.1 Color of patch cords shall be determined by the color code shown in detail drawings.
 - 2.18.2 Patch cords shall as manufactured by Commscope based on the Approved Network Infrastructure System furnished by the Contractor.
 - 2.18.3 Patch cords furnished must be in compliance with the manufacturer's "Channel" warranty requirements. Patch cords not warranted through the selected manufacturer Channel warranty program will not be approved for use with the network infrastructure.
- 2.19 Provide all other items as detailed on the drawings

Campus Indoor/Outdoor Fiber Optic Feed Cable

- 2.20 Provide one continuous fiber optic cable routed from the Main Distribution Frame fiber patch panel to each intermediate Distribution Frame fiber patch panel, and/or other locations as shown on the drawings.
- 2.21 Outdoor Fiber Feed Cable Applications – Fiber optic cable shall be rated for indoor/outdoor riser rated applications. Construction shall consist of, all dielectric, tight buffer with central strength member, flame retardant PVC or PE jacket, rated OFNR, dry water-blocking compound only, and blank fillers are required. Central tube type fiber will not be considered equal.
- 2.22 Fiber optic feed cables for the data infrastructure must be installed as follows:

- 2.22.1 Multimode Fiber Optic feed cable runs – Fiber optic feed cable containing only Multimode strands shall be installed as a single feed cable. Provide a 12-strand of multimode fiber optic feed cable in a single jacket, as shown on the riser diagram, to the IDF locations.
- 2.22.2 Feed cables shall be clearly defined and labeled for each system. Provide color coding designations with a different color marker for the multimode and/or single mode fiber feed terminations in the fiber patch panels.
- 2.23 Cable shall contain one or all types of fibers listed below:
 - 2.23.1 Provide Multimode 50/125-micron fiber optic glass, (minimum OM4+ laser-optimized grade, extended distance) for dual mode operation at 850 nm and 1300 nm wave lengths.
 - 2.23.1.1 Maximum attenuation at 3.0dB/km @ 850nm and 1.0dB/km @ 1310nm. Minimum 1-gigabit Ethernet distance guarantee of 1110 meters @ 850nm and 600 meters @ 1300nm. Minimum 10-gigabit Ethernet distance guarantee of 550 meters @ 850nm/1300nm. Fiber shall be ISO-TIA OM4 plus rated.
 - 2.23.2 Refer to drawings for cable types required. Refer to acceptable cables section for additional information and approved manufacturers.
- 2.24 Each fiber optic cable shall contain the quantity of strands of optical fibers as detailed on the drawings.
- 2.25 All fibers in a multi-fiber cable shall be fully operational within the required performance characteristics. If any individual fiber does not meet the minimum standards, the entire cable must be replaced, end to end, including connectors, without any additional expense to the customer.
- 2.26 Acceptable cables shall be:
 - 2.26.1 Commscope Multimode –Systimax LazrSpeed 550 OM4
- 2.27 Above glass types are an example of product names per manufacturer. Confirm requirements for indoor/outdoor, riser and plenum rated cable with riser drawings and site plans. Part numbers for composite style cable will vary greatly. Confirm part numbers with manufacturer

Category-6 Station Cable

- 2.28 Provide one Category-6, 4-pair, unshielded twisted pair (UTP) cable from the nearest MDF or IDF to each RJ45 data outlet port indicated on the drawings. Dual port outlets will require two such cables. Four port outlets will require four cables.

- 2.29 Category 6 cables shall be copper wire, individually insulated and color coded. Color for station cabling shall be provided as shown in the drawing details. Confirm color of cable jackets prior to ordering with the District IT Director. Contractor shall be responsible for providing the correct jacket color per the drawings per District Standards.
- 2.30 The cables shall be UL or ETL rated and UL verified in compliance with proposed Category-6.
 - 2.30.1 Commscope — CS37R
- 2.31 Manufacturer names and part numbers are shown as a point of reference and do not specifically designate required packaging or color for the cable. Contractor shall verify colors and packaging all options shall be determined by District preferences.
- 2.32 Where data cables are indicated to run underground, contractor shall use a Category-6 flooded cable: Comm Scope - Ultra Media Series - #6NF4

Category-6 Outlets

- 2.33 Unshielded twisted pair Category-6 outlets shall be an RJ45 Enhanced performance type 8-position / 8 conductor modular jacks, and shall comply with Category-6 performance requirements. Provide single port, dual port, four port or quantity as indicated on the floor plans at each outlet location. All outlets shall be wired in an EIA/TIA 568B configuration.
- 2.34 Provide Category-6 inserts, wired for EIA 568B. Provide installation kits for all locations furnished with Category-6 UTP cabling.
- 2.35 Refer to the detail drawings for color of the Category-6 outlets required. Contractor shall be responsible for confirming all color requirements prior to ordering.
- 2.36 Provide the following Category-6 UTP data connector per Network Infrastructure warranty requirements;
 - 2.36.1 Commscope - USL Series USL600

Outlet Faceplates

- 2.37 Provide a two-port faceplate for all one and two port outlet locations. Provide blanks for all unused openings.
- 2.38 Provide a four-port faceplate for all three and four port outlet locations. Provide blanks for all unused openings.
- 2.39 All fax/modem locations shall be provided as single port outlets. Requirements shall be the same as a single port data outlet as shown on the Technology Legend.

- 2.40 For single port voice outlet locations intended for wall telephone connections, a wall telephone type faceplate with attachment studs shall be provided. The wall telephone jack shall be 8-pin, RJ45 type and use IDC wire terminations only. Provide Category-6 insert, within stainless steel wall plate faceplate. Provide faceplate from the approved manufacturers listed in the specifications.
- 2.41 Wireless Access Point data connections for ceiling mounted WAPs shall be terminated above the accessible ceiling at the wireless access point (WAP) location. Refer to the drawing details for additional requirements.
- 2.42 Wireless Access Point – Provide data connections for WAPs terminated at the WAP location as shown in the drawing details. Provide surface mount box by Commscope Series 2-Port #M102SMB-B-262. Label the cables and faceplate the same as standard data outlets.
- 2.43 IP Clock/Speakers - Provide single port, small surface mounted box Commscope Series 1-Port #M101SMB-B-262, in White, for IP Clock/Speaker data outlets. Mount data outlet in back of IP Speaker enclosure. Label the cables and faceplate the same as standard data outlets.
- 2.44 IP Cameras - Provide data connections for IP-Based Camera Outlets terminated at the Camera location as shown in the drawing details. Provide surface mount box by Commscope Series 2-Port #M102SMB-B-262. Label the cables and faceplate the same as standard data outlets. The location shall also be furnished with a blank weather-tight faceplate to protect the data termination until the cameras are installed.
- 2.45 Audio-Visual/Projector Locations - Provide data connections for IP-Based Audio-Visual Outlets terminated at the AV/Projector location requiring a surface mount box type connection as shown in the drawing details. Provide surface mount box by Commscope Series 2-Port #M102SMB-B-262. Label the cables and faceplate the same as standard data outlets.
- 2.46 All faceplates and surface mount outlet boxes shall be furnished with label windows. All labeling shall be installed within the label window.
- 2.47 Confirm color of all faceplates prior to ordering. All data outlet faceplates shall have a unique sequential identification number applied to faceplate. Hand written labels are not permitted. All color schemes shall be approved by the customer prior to installation.
- 2.48 Colored inserts are required for this project. Refer to the detail drawings for the exact color scheme to be provided. Inserts submitted that do not follow the color and identification requirements will be rejected. Inserts installed that do not follow the color coding as shown in the detail drawings will be replaced at the Contractor's expense.

- 2.49 All labels will be installed under label windows. Labels adhered to the surface of the faceplate will not be accepted. Contractor must provide clear laminating type of cover material over the surface mounted labels where used.
- 2.50 Reference the drawings for special outlet configurations or plate requirements
- 2.51 All data outlet faceplates shall have a unique sequential identification number applied to faceplate. Refer to the detail drawings for labeling requirements. Hand written labels are not permitted. Faceplates, with the exception of wall telephone outlets, shall include color coded port inserts. All color schemes shall be approved by the District prior to installation.
- 2.52 Reference the drawings for special outlet configurations or plate requirements

Paging Speakers and Horns

- 2.53 Atlas/IED existing Speaker/Horn Standard on Campus (No Approved Equal). The IP-based Interior/Exterior Intercom Speakers and Horns shall be furnished by the District and installed by the Contractor. All Enclosures and Backboxes shall be Furnished and Installed by the Contractor. All programming of the IP-Based speakers shall be completed by the District.
- 2.54 All Analog Exterior Horns shall be furnished and installed by the 27 10 00 Contractor. The Contractor shall furnish and install the IP-Based Zone Controllers and Analog Amplifiers. Install equipment per the detail drawings and specifications.
- 2.55 The Contractor shall install the IP-Based Speaker/Digital Clock combinations in the classrooms where shown on the floor plans.
- 2.56 Data Contractor shall be responsible for providing enclosures for all speakers and horns. Contractor shall provide vandal resistant screws with all enclosures for attachment of the speaker/horn baffle. Exterior locations shall be provided with stainless steel vandal resistant screws.
- 2.57 Flush mount enclosures shall be furnished by the 27 10 00 Contractor and installed by the Division 26 Electrical Contractor as shown in the floor plans. 27 10 00 Contractor shall deliver enclosures to the Electrical Contractor in a timely fashion so as not to adversely impact the project schedule. Coordinate with Electrical Contractor and Construction Manager as long lead times are typical for this product.
- 2.58 Surface mounted enclosures shall be furnished and installed with vandal resistant screws for attachment of the speaker/horn baffle to the enclosure. If enclosure is located on the exterior of the building, the enclosure shall be provided with stainless steel vandal resistant screws.

- 2.59 Contractor responsible for proper paging coverage and tap settings at the speakers/horns.
- 2.60 All exterior loudspeaker circuits shall operate balanced to ground. Bonding shall be provided to assure equal potential measurement between the chassis of all amplifiers, power supplies, etc. Bond to the ground bus bar.
- 2.61 Each Analog Speaker/Horn location cable shall be home run to the IDF rack/cabinet. Provide 1-pair, 18-gauge CMR rated speaker cable to each horn location. Terminate speaker cable on terminal strips only. Punch Blocks will be rejected and are not an acceptable form of terminating the specified cable.
- 2.62 Contractor shall run a speaker cable from the amplifier to the page interrupter for the audio-visual system in each room. The connection will serve to cut off the audio from the AV system when the paging system is engaged. Coordinate the connection with the 27 21 00 Contractor and the 27 20 00 Contractor. Speaker connections to the AV system may be looped, but the Contractor is responsible for insuring that the signal strength is sufficient to allow the interrupter to operate properly.
- 2.63 Recessed flush mount IP Speaker/ Clock combination; Provide flush mount enclosure installed in gypboard wall with District furnished IP clock/speaker. Enclosure shall be as manufactured by Atlas Model #EST-I8SC.
- 2.64 Surface mount IP Speaker/Clock combination; Provide surface mount enclosure installed on gypboard wall with District furnished IP clock/speaker. Enclosure shall be as manufactured by Atlas Model # EA-I8SC.
- 2.65 Surface mount exterior horn; Provide Atlas Sound Part #APF-15T with surface mount vandal resistant enclosure Part # SE161-R6 and Part #VP161-APF baffle grille. Unit must be weather resistant.
- 2.66 Provide a (2) foot long, CAT-6, UTP patch cord, gray in color, for each speaker location to connect to the ethernet drop located in the enclosure. Provide patch cords for 100% of IP Speaker/clock locations. Provide (3) spare patch cords, deliver all Patch cords to the District IT Department.
- 2.67 The District shall be responsible for providing licensing requirements and Informacast software to drive speakers and program tones, bell schedules and announcement controls.
- 2.68 Programming of speakers/clock for page coverage zones, tones, time schedules, pass class bell and VoIP interface to be completed by the District IT Department and is also responsible for providing IP addressing and identification of individual speakers.
- 2.69 Provide Atlas IED IP-ZCM2RMK for even quantities or IP-ZCM1RMK (for single zone needs) at the IDF locations. The quantity of zone controllers to be furnished at each

closet location shall be dependent on the number of zones shown on the floor plans and the number of buildings serviced by the IDF closet. Contractor shall coordinate the zoning for the campus with the District IT Director.

- 2.70 Provide amplifiers for the analog paging speakers and horns connected to the zone controllers. Amplifiers shall be rack mounted in the MDF or IDF equipment rack or cabinet. Provide rack mount adapter bracket as required to mount one or two amplifiers in a single rack unit. Provide quantity of amplifiers to service the quantity of horns and speakers as shown on the drawings. A separate amplifier must be provided for each IP zone controller output. Size of amplifier shall be determined by the load, plus 25% expansion capacity. Larger amplifier may be required for a single zone depending on quantity of horns and speakers requiring amplification. Contractor is responsible for providing sufficient power amplification to service all speakers and horns. Contractor is responsible for connecting the amplifiers to the IP zone controllers and insuring proper operation between the zone controller and amplifiers.
- 2.71 Provide amplifier choice based on load: Approved Models; JBL CSA series, 280Z/2120Z or approved equal by Ashly. Total amplifier wattage on each channel shall allow for 20% headroom with speakers tapped according to the specifications. Contractor MUST submit a line diagram showing all locations and tap values with amp load as part of the Phase II submittals, see section 1 for more information.
- 2.72 Provide rack mount adapter bracket, one bracket for each pair of amplifiers provided. If there is a single amplifier to be installed at the rack, the amplifier would still require the rack mount bracket. Provide optional Level Control Security Covers for all models.
- 2.73 Contractor shall be responsible for testing all paging speakers and horns and insuring the proper volume levels are set on the paging devices and amplifiers. Provide (4) man hours (not including travel time) for re-adjustment of the paging speakers and horns volume levels per the District's requirements 4 weeks from the final sign-off of the modernization project. Travel time to and from the site shall be included in the service.

PART 3 - INSTALLATION

- 3.1 Upon completion of 10% of the cabling installation, the Contractor shall notify the Project Engineer for an inspection of the methods and types of materials used on the project. The Contractor shall give a minimum of 72 hours notification to the Project Engineer for the scheduling of the inspection. The Contractor will be given a written review of the findings, so if adjustments are required, they can be done before the project proceeds. The Contractor shall be responsible for adhering to the findings and a follow-up inspection will not be provided.
- 3.2 Pull strings shall be provided with all cable runs including but not limited to: conduit stub ups, conduit sleeves, cable trays, open wiring routes, innerduct and point-to-point conduits. Pull strings shall be free from cable bundles in open wiring routes. Pull strings shall not be substituted for pull ropes for the exterior site conduits.

- 3.3 Velcro cable management straps are required on all Category-6 cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart. Cable bundles shall also be routed through cable managements or "D" rings in the equipment closet.
- 3.4 Data Contractor shall supply protective bushings or slide on rings at the ends of all exposed conduits used for data system cabling. This is to include all conduits installed for any future data cabling requirements. Contractor shall submit planned protection bushings prior to installation of cabling for approval.
- 3.5 Velcro cable management straps are required on the cabling in the rear section of the vertical managers in the equipment racks. Straps shall be a maximum of 12" apart. At a minimum, Velcro straps shall be provided at each point the cables are routed to the patch panels from the main bundle.
- 3.6 Every fiber in every fiber optic cable must be terminated at both ends of a fiber patch panel in the MDF/IDF closet or cabinet location. Termination shall be accomplished using the correct style of connectors as directed by the specifications with a strain relief boot. All connectors shall be of the same manufacture to ensure compatibility. Polarity of fiber strands must be observed at all times.
- 3.7 Labeling
 - 3.7.1.1 Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and patch panel point. A printed label shall be placed at each of the following locations:
 - 3.7.1.2 On the cable at the rear of the patch panel or termination block. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 3.7.1.3 On each cable in the j-box behind the faceplate location. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 3.7.1.4 On the cable at the terminal strip prior to termination point. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 3.7.1.5 On the face of the patch panel, provide a ¾" by ¾" label with a letter or number identifying the patch panel designation. For special purpose data connections such as WAP, Audio-Visual, IP

Page and IP Camera ports, the label shall be designated with colored label icon or marker.

- 3.7.1.6 On the face of the faceplate in the label holder window. The label shall be clearly defined with a minimum #10 font size.
- 3.7.1.7 Handwritten labels are not permitted. Where cable ID includes room number identification, the Contractor shall obtain written verification of final room numbers prior to beginning labeling (numbers on plans do not always match final room numbers). Cable pulling cross reference lists will not be accepted with final documentation.
- 3.7.1.8 Each patch panel port shall be identified with a unique sequential labeling scheme. Port identification labeling pattern shall be consistent throughout the project.
- 3.7.1.9 All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.
- 3.7.1.10 All fiber optic and UTP feed cables shall be identified with permanent, water resistant, printed labels. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands (fiber) and house pair designations (UTP). Cables shall be labeled in the IDF/MDF closets at the site conduit entrance point, riser conduit entrance point and prior to entering either punch blocks or patch panels. Labels for fiber and copper feeds shall include both the name of the origination point and the destination point, house pair or house fiber strand count, cable composition (i.e., 12-Strand MM 50/125 LO; 6-Strand SM). See details for additional requirements.
- 3.7.1.11 Labeling will follow recommended EIA/TIA standards or as requested by the customer. Contractor will confirm labeling pattern prior to final identification or testing. All test results will be identified by the final labeling scheme. Contractor shall be required to have the labeling scheme approved in writing by the District IT Director prior to manufacture or installation of the labeling.
- 3.7.1.12 All fiber optic cables and/or innerduct shall be tagged with fiber optic warning tags in every manhole or pullbox. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end, with a label tag on each cable in the service loop. Fiber warning tags shall be placed on fiber optic cable and/or innerduct routed through open ceiling environments at increments no less than 15 feet apart.

- 3.7.1.13 Refer to detail drawings for additional labeling requirements.
- 3.8 Where open wiring cables are run through the ceiling space (only permitted where specifically noted on the drawings), the wire shall be bundled together and supported above the ceiling.
- 3.9 All cables must be fastened to the building structure via “j-hooks” or an approved Category 6 suspension system, and not directly in contact with ceiling system. For “j-hooks” maximum fill capacity is as follows: 1-5/16” hooks – 35 cables; 2” hooks – 60 cables; 4” hooks – 120 cables. For quantities beyond 120 cables, use a sling support system such as “Erico Cable Cat” or equal. Maximum fill capacity 200 cables. D-rings, “Caddy #WMX cable hangar”, “Caddy Bridle Rings”, drive rings or any other type of wire ring support is not allowed.
- 3.10 Where cables pass through a fire-resistant portion of the structure, conduit sleeves shall be provided to maintain the rating of wall penetrated. Sealing of all penetrations with an approved fire barrier is required. Conduits and sleeves must remain accessible for future use. Permanent sealants may not be used to seal sleeves and conduits.
- 3.10.1.1 The 27 10 00 Contractor shall be responsible for fire-stopping all unused conduit sleeves in the ceiling or through rated walls. The Electrical Contractor shall be responsible for fire-stopping around the conduit or sleeve, unless the sleeve is installed by the 27 10 00 Contractor, in which case, the 27 10 00 Contractor shall be responsible for all fire-stopping requirements.
- 3.10.1.2 Expanding foam is not an acceptable sealant for any conduit opening. Contractor shall be responsible for complete replacement of the conduit and cabling in any conduit filled with expanding foam used as a sealant.
- 3.11 Fiber optic feed cables connecting to equipment racks from the MDF Room or from an adjacent IDF location, shall be installed with not less than a 20-foot service loop between the rack and mounted on the backboard. See drawings for fiber optic service loop requirements.
- 3.12 Provide 6 inches of cable slack at computer data system outlets inside conduit box.
- 3.13 In an accessible ceiling area, provide a 10-foot (stored in a Figure-8 configuration) service loop above the all data/voice outlet locations. Service loop must be securely tied up off of ceiling tiles or ceiling surface and supported at two opposite points. Neatly coil cable without exceeding minimum bend radius limitations. Do not provide length in excess of 15 feet, as it may cause improper test results and errors.
- 3.14 Do not provide a service loop in the MDF/IDF Room on the UTP cables, unless otherwise noted. Cables shall be neatly routed around the perimeter of the room to the cable runway from the point of entrance into the room.

- 3.15 The minimum bending radius for all cables and the maximum pulling tension shall not exceed manufacturer's recommendations.
- 3.16 Cables installed in manholes and pullboxes shall be supported with Velcro ties or loosely fitted UV rated tie wraps, on wall mounted cable support racks. The cables shall be clearly labeled in the manhole or pullbox.
- 3.17 Provide a full 360-degree loop of slack cable around manhole and pullbox interiors. Cables entering handholes from the bottom, shall not be allowed to touch the bottom of the cover when closed and shall not be pinched or crushed in any way.
- 3.18 Cable pulling shall use a split mesh grip over the cable jacket. Connection directly to optical fibers and copper wire conductors shall not occur.
- 3.19 When pulled through conduits, cable pulling lubricants shall be continuously applied to all cables and be specifically approved by the manufacturer.
- 3.20 Where cables are pulled through or pulled from a center run, pull without splices or terminations, lead out the cables at all manholes, pullboxes, and conduits, taking care to feed them in again by hand for the next run.
- 3.21 For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves, etc., shall be used to ensure proper cable pulling tension and side wall pressures. Cables shall not be pulled directly around a short right-angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space shall be provided in all situations, to ensure the minimum possible cable sidewall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
- 3.22 Cable lengths over 250 feet shall be machine pulled, not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum pulling speed shall be greater than 15 feet per minute.
- 3.23 A pull string shall be placed with all UTP and paging station cables at the time of installation. Conduit runs and surface raceway for station cabling shall be furnished with a minimum 2-Ply spiral wrap style, pull string rated for 240 ft/lbs. pulling strength, such as manufactured by Greelee #431 or approved equal. Includes all conduit stubs and cables routed through open ceiling and cable trays. Pull strings shall be tied off in the junction box and in the ceiling. Provision for the installation of the pulls string shall apply to all empty and spare conduits as well. Single ply type pull string will not be accepted as a substitute for the 2-ply pull string.

- 3.24 A measuring pull tape shall be placed with all feed cables at the time of installation. Indoor riser and outdoor conduit runs between buildings designated for feed cabling, in excess of 150 feet shall be provided with a minimum ½" polyaramid style, measuring true tape pull string annotated with footage increments rated for 2500 ft/lbs. pulling strength, such as manufactured by Greenlee #39245 or approved equal. Conduit runs less than 150 feet shall be furnished with a ¼" polyaramid style, measuring true tape pull string annotated with footage increments rated for 1250 ft/lbs. pulling strength, such as manufactured by Greenlee #39243 or approved equal. Provision for the installation of the measuring pull tape shall apply to all empty and spare conduits as well. Standard twine style pull strings and standard nylon or polypropylene style pull ropes will not be accepted as a substitute for the polyaramid measuring tape pull string.
- 3.25 When pulling cable through conduit, cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to the reel). Keep pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pullbox during this operation. Cables shall be pulled directly from cable reels.
- 3.26 All cables shall be new and extend continuous from each MDF or IDF backboard or rack to all outlet locations.
- 3.27 Where cables are not installed in a conduit or other raceway system, they shall not be routed parallel with other line voltage equipment or wiring (120 volt and above) with 36" or within 12" of line voltage equipment or wiring where crossing.
- 3.28 Where OSP-Rated UTP cables or OSP-Rated fiber optic cables are routed exposed through ceiling for more than 50'-0", Contractor shall install the cable in innerduct or EMT conduit in the ceiling. Innerduct installed in the accessible ceiling space shall be a minimum of riser rated and minimum of 1" in diameter. Innerduct shall be supported minimum of every 3-feet to the structural members.

PART 4 TESTING

- 4.1 All Category-6 cables shall be point to point (link) tested after installation/termination and verified to operate at minimum 1000Mbps. Performance of installed cables shall satisfy all current addendums to the EIA/TIA 568A standard for Category-6 wiring. In addition, testing shall satisfy all proposed amendments to the existing ISO/IEC requirements. The wiring shall support all specified communication protocols. Testing shall support the Category-6 requirements by the EIA/TIA.
- 4.2 All Category-6A cables shall be point to point (link) tested after installation/termination and verified to operate at minimum 10Gbps. Performance of installed cables shall satisfy all current addendums to the EIA/TIA 568A standard for Category-6a wiring. In addition, testing shall satisfy all proposed amendments to the existing ISO/IEC requirements. The

wiring shall support all specified communication protocols. Testing shall support the Category-6 requirements by the EIA/TIA.

- 4.3 Upon completion of testing cable links for both copper and fiber optic cabling, the Contractor shall supply a copy of the original database files downloaded from the tester in original format on a USB Flash Drive. Contractor shall provide with the testing database files, an original copy of the tester's manufacturer software program (included in original cost) for record management and archiving, in a Windows format (i.e., Fluke Linkware software program).
- 4.4 The manufacturer's software program will be used by the Project Engineer to review all test results, and then turned over to the District to keep as their record copy with the final approved test results. Provide (3) copies of tests on USB Flash Drives. Do not submit test results for review in Excel or PDF file formats, as the submittal will be rejected and not reviewed.
 - 4.4.1.1 Contractor will repair or replace cable runs or connecting hardware that do not meet specified criteria.
- 4.5 Multimode fiber optic cables shall be tested bi-directionally at 850nm and 1300nm. All fiber strands shall be tested with an OTDR (Optical Time Domain Reflectometer). All fiber test results shall contain final source and destination information that matches IDF or MDF labeling shown on the fiber optic patch panels and final documentation. OTDR tests results shall be included with the copper test results and submitted with the tester's software for review. Do not submit test results for review in Excel or PDF file formats, as the submittal will be rejected and not reviewed.
 - 4.5.1.1 Test procedures shall comply with EIA/TIA 526-14 Method B. Test results shall meet the minimum following criteria:
- 4.6 Fiber optic test results shall not exceed 2db total attenuation loss in addition to inherent loss published by manufacturer tested at minimum 2000 Mhz for 805nm and 500 Mhz for 1300nm for the fiber optic cable.
- 4.7 End to end attenuation Fiber Optic feed cabling testing shall be performed with a temporary test jumper cable at each end of the installed fiber cable. The test jumper utilized shall be the same fiber core size and grade of glass as the installed cable. The measured attenuation of the test jumpers, test connectors, and test interconnection sleeve between the two test jumpers shall be less than 1dB as calibrated at the time of the test at indicated wave lengths and frequencies. Test jumpers shall be "zeroed out" before testing of fiber stands begins.
- 4.8 Final As-Built Drawing Submittals – Provide (1) hard bound copy of "E-size" As-Built drawings and (3) copies on USB Flash Drive in AutoCad (2019 or newer version) format. A Hand marked-up copy of the original construction drawings will not be accepted as the final As-Built drawing submittal. Final As-Builts shall include copies of the floor plan

drawings of each building, detailed elevations of each MDF or IDF locating all equipment, quantities outlets and speaker locations, locations of all sleeves and identification of all final cable routes. In addition, the drawings shall include all outlet locations with cable identification numbers.

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SECTION 27 20 00
INTEGRATED AUDIO/VISUAL SYSTEM

PART 1 – GENERAL

SUMMARY

- 1.1 The Contractor shall furnish all labor, project management, materials, tools, equipment, and resources necessary for the installation, startup, and testing of the system shown on the plans and described in the specifications.
- 1.2 Related Specification Sections:
 - 1.2.1 Section 26 01 00 -General Provisions
 - 1.2.2 Section 26 05 33 -Conduit and Fitting
 - 1.2.3 Section 26 05 19 -Conductors
 - 1.2.4 Section 26 05 34 -Outlet and Junction Boxes
- 1.3 The Contractor shall furnish and install the system as defined by the plans and specifications. The Contractor must demonstrate to the Owner that the system is complete and complies with all operational requirements set forth in the plans and specifications.
- 1.4 The work covered under this section of the specifications consists of furnishing all labor, equipment, supplies and materials, and in performing all operations necessary for the turnkey and fully completed installation of an audio/ video system in accordance with the specifications and accompanying drawings, except as specifically noted otherwise.
- 1.5 Cables for the system shall be pulled through the conduit systems furnished by the building contractor. The 27 20 00 Contractor shall be responsible for providing all cables required and for coordinating and supervising the cable installation. The 27 20 00 Contractor shall be responsible for ensuring the integrity of the cables before and after installation.
- 1.6 Work Excluded:
 - 1.6.1 Excluded from this work shall be any and all general construction services regarding masonry and general carpentry services. Those services are to be provided and installed by the general contractor.
 - 1.6.2 Conduit/raceways, sleeves, cable trays, electrical boxes, hand holes, pullboxes, etc. required for the system shall be furnished and installed by the Electrical Contractor. The conduit/raceways and electrical boxes furnished and installed under Electrical Contractor shall conform with the requirements of the drawings and specifications for the system.

- 1.7 In order to ensure project cohesion a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all labor; cabling; equipment; software; supplies; materials and training. The contractor will perform all operations necessary for the "TURNKEY" and fully completed installation in accordance with the specifications herein. As such, the successful contractor must be factory trained on all aspects of system hardware. The successful contractor shall be a California licensed C7 or 10 premise wiring contractor as defined in this specification. Subcontractors may not be utilized in the implementation of the plant wiring installation.
- 1.8 Approval to bid shall not release the Contractor from full specification compliance requirements. Final system acceptance testing shall govern final system acceptance and compliance with the specifications.
- 1.9 Failure to provide a functional equivalent shall result in the removal of the alternate system at the contractor's expense.
- 1.10 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.
- 1.11 Where the words 'provide' or 'provision' is used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.
- 1.12 Where items are specified in the singular, this division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

DEFINITIONS

- 1.13 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings - acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- 1.14 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.
- 1.15 Finish Space: Any space ordinarily visible, including exterior areas.

Contractor Qualifications

- 1.16 The successful bidder shall be a California licensed C7 or C10 premise wiring contractor as defined in this specification. Subcontractors may not be utilized in the implementation of the installation or programming.

- 1.17 The successful bidder shall have design staff with CTS certification and Extron Advanced A/V Certifications.
- 1.18 The successful bidder shall have installation staff with CTS certification and Extron Advanced A/V Certifications.
- 1.19 All bidders must provide a listing of two similar size projects having the same scope of work using the proposed information delivery equipment. This listing shall be complete with facility names, completion dates, names of contacts, and their telephone numbers. Referenced projects must have been completed in the past 18 months.
- 1.20 The bidder shall have a factory trained service department the service department shall be on call 24 hours a day, 365 days a year, to arrive and initiate onsite service the specified equipment upon (24) hours notice.
- 1.21 The Contractor shall employ factory-trained technical/service personnel for service and maintenance of the system. Their résumés will be required. The factory-trained technical/service personnel shall have a minimum of two years experience installing the proposed system. The Bidder shall submit the names and copies of the certificates issued by the factory. The bidder shall instruct the Owner's technical personnel in the operation, care, and maintenance of the system.

CODE COMPLIANCE

- 1.22 All material and equipment shall be clearly listed, labeled, or certified by Underwriters Laboratories, Inc. All power supplies and computers shall be clearly UL Listed. Any system which is not UL Listed at time of bid will be rejected.
- 1.23 All acceptable systems shall be approved under Part 15, Subpart B, Section 15.107b of the FCC Rules and Regulations. Bidders must provide the FCC Registration Number of the proposed system. Systems that are not in compliance with the FCC will not be considered. Any system that is not FCC compliant at time of bid will be rejected. All equipment must be clearly labeled with FCC compliance stickers.
- 1.24 The system shall be installed in accordance with local and national electrical codes.
- 1.25 The manufacturer and contractor shall provide the Owner with a release for use of all copyright materials, corporate logos, and corporate trademarks at time of bid.

SUBMITTALS

- 1.26 Index all submittals and reference to these specifications. All submittal items shall be assembled and submitted in a single complete binder per submittal group. Partial submittals will not be reviewed. Submit items in groups as indicated below: All submittals, warranty information, close - out documents, and as built documents must be submitted independently for owner, in order to provide record documentation for the project owner.

- 1.27 Group # 1 Submittal shall be made within (20) working days after the award of the contract. This submittal shall include the following:
- 1.27.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:
 - 1.27.1.1 Quantity of each type of equipment item
 - 1.27.1.2 Description of each item
 - 1.27.1.3 Manufacturer's Name and Model Number
 - 1.27.1.4 Manufacturer's Specification Sheet
 - 1.27.1.5 Equipment items which have individual components will require that all component parts be listed individually.
 - 1.27.1.6 Description of any specialty backbox requirements
 - 1.27.1.7 All wiring types required for installation of this system
 - 1.27.1.8 Copy of equipment warranty
 - 1.27.1.9 Spare parts shall be listed individually to verify proposed quantity
- 1.28 Group # 2 Submittal shall be provided within (20) working days after the approval of the Group # 1 submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD System. Contractor shall make the request for drawings in writing directly to Johnson Consulting Engineers, confirmation of the request and a release form will be forwarded to the contractor to include a signed copy with payment prior to release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the contractor. Phase II Submittals drawings shall include the following:
- 1.28.1 Furnish complete shop drawings for all systems specified. Each drawing shall have a descriptive title and all sub parts of each drawing shall be completely described. All drawings shall have the name of the project, architect, consultant, and electronics contractor in the title block.
 - 1.28.2 Furnish complete scaled drawings of all equipment racks, consoles, special assemblies, etc. Each drawing shall show all equipment with its manufacturer and model number.
 - 1.28.3 Furnish complete scaled installation drawings detailing locations of all equipment such as control panels, plug panels, video monitors, video projectors, equipment racks, speakers, etc. All conduits with cable quantities and types and all terminal block locations shall be shown also.
 - 1.28.4 Provide single line riser diagrams of all racks, consoles, control panels, speaker assemblies, etc. Each drawing shall delineate circuit numbers for all cables and terminal connections. Provide typical wiring termination for all devices.

- 1.29 All equipment items referenced by manufacturer name and model number shall be the only approved product to be furnished for use on this project. Where alternate items are acceptable (or approved alternate) will be noted with the product description.
- 1.30 Products as manufactured by “Extron” have been specified to coordinate with an existing facility and other contracts to be issued for this project. Alternate products will not be approved.

SEISMIC ANCHORING

- 1.31 All sound systems, A/V equipment or enclosures shall be anchored to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1632A and Table 16-A0. The contractor shall submit drawings signed by the contractor’s registered structural engineer indicating method of compliance prior installation.

CLEANUP

- 1.32 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.
- 1.33 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- 1.34 During the progress of the work, keep the premises clean and free of debris.

GENERAL COORDINATION

- 1.35 The A/V drawings may reference components by manufacturer which conflict with the written specification requirements, where this occurs the written specifications shall be followed.

PART 2 — PRODUCTS

Standard Classroom Projection System

- 2.1 Contractor shall furnish and install all components as shown. Refer to detail drawings for exact installation configuration. All Laptops and/or Computer shall be furnished by the District and installed by the District.
- 2.2 Contractor shall furnish and install a new Projector and Projection Screen in the Classrooms or other spaces shown on the drawings. Refer to the Detail AV Diagrams for additional information.
- 2.3 Contractor shall furnish and install all projection system components as shown in the A/V system details and specifications. System shall consist of components that will use the projector as the audio-visual switch. All video inputs shall be directly wired to the

projector. Audio shall be routed as shown in the AV Wiring Diagrams, in the detail drawings, to allow the Amplified Speaker System to serve as a system-wide amplification device. Refer to the detail drawings for additional installation configuration requirements, mounting systems and additional parts.

- 2.4 Provide installation of projection screens for the Classroom Audio-Visual Systems. The projection screens will be manual, non-tensioned, surface mounted type. Projection screens shall be located per the drawings.
 - 2.4.1 Contractor shall install projections screens to the height shown on the floor plans. Screen height shown is to the top of the screen case.
 - 2.4.2 Contractor shall provide all hardware and structural support including, but not limited to brackets and hardware. All screens must be installed to comply with local codes and seismic requirements.
 - 2.4.3 All new projection screens will require a structural support mechanism to the building structure. The basic requirements will be shown in the detail drawings, but the exact requirements must be field verified by the Contractor. Contractor shall refer to the drawing details for the type of structural support system to be provided based on the type of screen used and the building conditions. The Contractor shall furnish and install all support.
 - 2.4.4 Coordinate the screen's location with the installation of the projectors. The location of both the projector and screen must be properly coordinated to insure the proper image size and orientation. Projector and screen locations shown on the floor plans are diagrammatical. Exact locations must be field verified by the Contractor prior to the installation of either component.
- 2.5 Provide Manual Wall Mounted Projection Screens in the Classrooms with the following;
 - 2.5.1 Da-Lite Model "C" with CSR Projection Screen with White Metal Case
 - 2.5.2 50" H x 80" W or 94" Diagonal at 16:10 Aspect Ratio
 - 2.5.3 High Contrast Matte White Screen Material with a Half Angle of 50° and a Viewing Cone of 100°, Gain of 1.1
 - 2.5.4 Da-Lite Wall Mount Floating Brackets Option #77027, White Color. Refer to the drawing details for mounting requirements.
 - 2.5.5 Provide optional 38" Long Pull Rod #74689 for all screens. Refer to the floor plans for quantity of screens.
- 2.6 Provide Manual Recessed Ceiling Mounted Projection Screens in Hard Lid in the Classrooms with the following;
 - 2.6.1 Draper Model Access Fit M with Auto Return Projection Screen with White Metal Case;

- 2.6.2 50" H x 80" W or 94" Diagonal at 16:10 Aspect Ratio
 - 2.6.3 Contrast White Screen Material XH1100E with a Half Angle of 90° and a Viewing Cone of 180°, Gain of 1.1.
 - 2.6.4 Provide (1) Additional Set of Draper Mounting Brackets Option for a total of (4) Mounting Brackets being used for screen. Refer to the drawing details for mounting requirements.
 - 2.6.5 Provide optional Aluminum 6-Foot Long Pull Rod #227010 for Manual Recessed Ceiling Mounted Projection Screens in Hard Lid. Refer to the floor plans for quantity of screens.
- 2.7 Provide installation of projectors with audio/video components, mounting systems and all local wiring as shown in the drawing details. Projectors shall be located per the drawings and specifications.
- 2.7.1 Projectors shall be furnished and installed by the Contractor. Projector must be able to fill a 94" diagonal size screen (16:10 aspect ratio) from a distance not greater than 14'6" from the surface. Projectors shall be the non-interactive type. Contractor shall be responsible for furnishing and installing the all software, tools and control systems as required for proper operation. Each of the projection system must be properly calibrated during the installation process to allow for the images and inputs to be presented properly.
 - 2.7.2 The Contractor shall install the projector using the complete manufacturer installation instructions in the installation manual. The Contractor shall follow all the steps shown for complete calibration of the image size and position on the screen. Projectors shall be leveled to insure a proper image shape. Projectors may not be tilted or skewed to align the image with the projection area on the screen. Do not make the adjustments to the image size with the keystone functions.
 - 2.7.3 The Contractor shall be responsible for the image size and proper operation of the projector until the project is signed off by the District Project Manager and the Project Engineer. Changes in the orientation of the projector due to incidental contact during construction shall be resolved by the Contractor
- 2.8 Provide (1) Epson PowerLite L200W 3LCD Long Throw Laser Projector in each Classroom or other Room shown on the drawings. Provide a Total quantity of (5) Epson PowerLite L200W 3LCD Long Throw Laser Projectors.
- 2.8.1 Contractor must field verify the throw distance of the projection image prior to installing the projector in case the actual field layout has changed. The projector's location on the drawings is diagrammatical.
 - 2.8.2 Projector shall meet the following minimum requirements;
 - 2.8.2.1 4200 Lumen Brightness 3LCD Laser Diode Light Source

- 2.8.2.2 WXGA (1280X800) Resolution, 16:10 Aspect Ratio
 - 2.8.2.3 Light Source (Lamp) Life Up to 20,000 hours (Normal Mode)
 - 2.8.2.4 Focal Length 18.2mm-29.2mm/F-Number 1.51-1.99/Manual Optical Zoom 1-1.62 and Manual Focus
 - 2.8.2.5 Minimum Inputs/Outputs; 2X HDMI IN; 2X VGA IN; 1 Composite Video IN; 1X VGA OUT; 1X Stereo Audio IN; 2X 3.5mm Audio IN; 1X 3.5mm Audio OUT; 1X 3.5mm Mic IN; 1X RS-232 Control; 1X USB-A; 1X USB-B; 1X RJ-45 Ethernet LAN
 - 2.8.2.6 Remote Control
 - 2.8.2.7 Provide Optional Wireless LAN Module #ELPAP11
- 2.9 Projector mounted in the accessible ceiling shall each be provided with the following;
- 2.9.1 (1) PEERLESS CMJ455 2' x 2' PROJECTOR MOUNTING PLATE (Or Approved Equal)
 - 2.9.2 (1) 1.5" NPT THREADED EXTENSION POLE (Adjustable or Fixed Length Pipe) field verify correct length
 - 2.9.3 (1) ACC455 HANGAR BRACKET KIT-FIELD with steel braided cables and all necessary mounting hardware. See drawing details for installation and anchorage requirements
 - 2.9.4 (1) Universal Fine-Tune Projector Mount by Premier Mounts model #RPAUW in white (Or Approved Equal).
 - 2.9.5 Structural support and anchorage as shown in the Electrical and Architectural Drawings and Details.
- 2.10 Projector mounted in the accessible ceiling shall each be provided with the following;
- 2.10.1 (1) PEERLESS CMJ455 2' x 2' PROJECTOR MOUNTING PLATE (Or Approved Equal)
 - 2.10.2 (1) 1.5" NPT THREADED EXTENSION POLE (Adjustable or Fixed Length Pipe) field verify correct length
 - 2.10.3 (1) ACC455 HANGAR BRACKET KIT-FIELD with steel braided cables and all necessary mounting hardware. See drawing details for installation and anchorage requirements
 - 2.10.4 (1) Universal Fine-Tune Projector Mount by Premier Mounts model #RPAUW in white (Or Approved Equal).
- 2.11 Structural support and anchorage as shown in the Electrical and Architectural Drawings and Details

- 2.12 Teachers Audio-Visual Interface Wallplate; The “2P/LO” Wallplate shown on the drawings will serve as interconnection device to the Classroom AV System. Provide all patch cables for the system. See Classroom AV System Diagram for Wallplate in the Detail Drawings requirements. Provide the following interface at the Laptop Wallplate;
- 2.12.1 Provide Single Input HDMI Pass-Through Wallplate with Audio at Laptop (2P/LO) locations shown on the floorplans. Wallplate shall consist of (1) HDMI Pass-Through Input with 3.5mm Audio. Provide (1) Extron WPD-110A HDMI with Audio Decora Style wallplate per location in a dual gang box.
 - 2.12.2 All Wallplates shall be white in color, unless otherwise noted, Extron Decora style, with color matched screws. Each Input wallplate location requires a dual gang box and trim ring. Provide (1) Dual Gang Decora Style Faceplate and (1) Single Gang Decora Blank Insert to be installed with the HDMI Input Wallplate.
 - 2.12.3 Provide Fiber Optic/Copper Hybrid HDMI Cable from the Extron #WPD-110A HDMI Wallplate to the Ceiling Mounted Projector’s HDMI Input #1 where shown on the floor plans. The slack from the Fiber Optic/Copper Hybrid HDMI Cable shall be neatly dressed and stored in the ceiling above the Projector. Provide J-Hooks above the ceiling to properly support cable.
 - 2.12.4 Contractor shall furnish and install (1) 12-Foot High Speed 90° Swivel-Type HDMI patch cable to the Instructor’s Laptop or PC. The 90° HDMI end of the patch cable shall be connected to the faceplate to allow the cable to drop straight down along the wall. Refer to the patch cable section for the exact patch cable requirements.
 - 2.12.5 Contractor shall furnish and install (1) 12-Foot 3.5mm Audio patch cable is for the “ALS Audio Output” and not for playback of local devices. Refer to the patch cable section for the exact patch cable requirements.
- 2.13 Provide all cabling as shown in the Classroom AV System Diagram wiring diagrams. Contractor shall provide all patch cables required in the wiring diagram and as required to provide a fully operational system.
- 2.14 Video and Audio outputs from the District Provided Laptop Computer shall be connected to the Local Origination (LO) Wallplate as shown in the detail drawings.
- 2.15 Each “2P/LO” Input wallplate shall be furnished with a 2-Port Data Outlet furnished by the 27 10 00 Contractor. Coordinate with the 27 10 00 Contractor for Data Outlet location requirements.
- 2.16 Provide Self-Amplified Three-Input Speaker Package for the Classroom AV System as manufactured by OWI #2X2-HD-IW83 (No Approved Equal) with HD Amplifier in each Classroom shown on the Floor Plans. Self-Amplified Speaker Package shall be provided with the following;
- 2.16.1 8” 3-Way Speaker with Drop-In Tile Type Full 2’X2’ Grill, 40W HD 8-Ohm Amplifier, 3-Source Inputs (Balanced Line Level, 3.5mm Stereo and Proprietary

RJ45), Balanced Audio Output, Proprietary RJ45 Audio Output, (3) Speaker Outputs, and 25/70V Transformer Power Supply. Page Interrupter shall be provided separately and is not provided with the Self-Amplified Speaker Package.

- 2.16.2 The Self-Amplified Three-Input 8" 3-Way Speaker shall serve as the Main Audio Source/Controller for the Classroom AV System. Contractor shall furnish and install all cabling and components associated with the Speaker System shown on the Classroom AV System Diagram and in these specifications. Volume Control for the Speaker System shall be provided by the Projector Remote Control Unit.
- 2.16.3 Provide OWI #AMPPOP1 Priority Page Module Interrupter/Controller at 8" 3-Way Speaker location for muting of the AV System Speakers when the Classroom receives a page notification on the Campus Intercom system. Priority Page Module shall be wired from Priority Page Module to the IP-Based Intercom Speaker in the Classroom. Connect to the audio contact closure for page shunting of local audio. This shall be installed in the AV vault
- 2.16.4 Provide (1) OWI #2X2-IW83 8-Ohm 6.5" Coaxial Non-Amplified Speaker with Drop-In Tile Type Full 2'X2' Grill Secondary Speaker for the Classroom AV System. Install Speaker where shown on the floor plans.
- 2.16.5 Audio-Visual System Speakers symbols shown on the floor plans do not differentiate which Speaker is the Self-Amplified Three-Input 8" 3-Way Speaker and which Speaker is the Non-Amplified Secondary Speaker. Contractor shall determine the locations of each type of Speakers in the field.
- 2.16.6 Speakers shall be positioned to provide the maximum coverage for the Classroom or Designated Room space. Coordinate placement of the speakers with the Architectural, Mechanical and Electrical drawings to avoid lighting, HVAC and fire alarm devices. Color shall be white. Volume shall be set by contractor and controlled via the Projector Remote Control and Input Source audio controls.
- 2.16.7 Self-Amplified Three-Input Speaker shall be provided with Master Volume, Bass, Treble, Gain, Priority Page/Trigger Level and Speaker/Line Level Controls.
- 2.16.8 Provide OWI 2X2 Suspended Ceiling Plate and Speaker Back-can for the Speakers. Contractor shall provide structural support for the Speakers as shown in the Detail Drawings.
- 2.16.9 Provide Self-Amplified Three-Input Speaker power supply shall be plugged into the electrical outlet located at the Projector. Provide a 2-Conductor cable from the 15VDC Power Supply to the Self-Amplified Speaker. Connect the cable to the power input terminals on the Main Circuit Board.
- 2.16.10 Provide Balanced Audio Out cable connection to the 3.5mm Connector on the Extron WPD-110A HDMI Input Wallplate. The Audio Output shall be used for connection to the Portable ADA Assistive Listening System. Contractor shall

label the 3.5mm Mini Connector on the Wallplate with "ALS Audio OUT" to identify the port.

- 2.17 Provide additional items as shown on the A/V wiring details and diagrams.

Flat Panel Audio-Visual System

- 2.18 Provide installation of Flat Panel Audio-Visual System in the Coaches Office Room #909 with audio/video components and all local wiring. Flat Panel Displays shall be located per the drawings and provided with components per the specifications. Refer to the drawing details for the flat panel mounting requirements and refer to the floor plans.

- 2.19 Document Cameras, Laptops, and Personal Computers shall be furnished by the District and installed by the District. Provide cable loom wrap around all patch cables from devices to the wallplates.

- 2.20 Provide lump sum of \$6,500 for the purchase of (1) 75" LED Flat Panel Monitor for the Coaches Office Room #909 with advance replacement service contract. Lump sum amount shall cover the Flat Panel Display and Service Contract invoice costs only plus tax. Shipping, Contractor mark-up, installation & programming set-up, all mounting hardware, labor costs shall be included as part of the contractor bid and not part of the lump sum. Actual make and model of Flat Panel Displays will be determined prior to installation.

- 2.20.1 **Lump sum amount shall cover Flat Panel Monitors invoice cost only plus tax.** Shipping, Contractor mark-up, profit and overhead, installation, patch cables, programming and set-up, all mounting hardware and labor costs shall be included as part of the Contractor bid and not part of the lump sum amount. Actual make, model and final size of Flat Panel Monitors will be determined prior to installation and shall be approved by the Project Engineer and District Project Manager prior to purchase.

- 2.20.2 Contractor shall submit an itemized spreadsheet to the Project Engineer, Architect, Construction Manager and District Project Manager for the monitors being proposed for purchase including the following information; Make, Model, Size (Diagonal), Native Resolution, Invoice Cost and Tax. The submittal shall include manufacturer cut sheets for each type and size of each model submitted, with proper part numbers highlighted. The itemized spreadsheet shall detail each location with Room Number and the associated Flat Panels (and sizes) for that room. The spreadsheet shall be provided to the Construction Team a minimum of 12 weeks prior to the first proposed purchase date to allow enough time for approval, purchase and delivery of the Flat Panels. The Contractor shall not proceed with purchase or warehousing of the equipment without written approval.

- 2.20.3 The specified 75" Larger Flat Panel shall be installed on the East wall directly where shown on the drawings. Local Input Wallplate shall be Installed below the

Flat Panel on the wall. Refer to the Electrical and Architectural floor plans for additional information on the location of the Flat Panel.

2.20.4 Flat Panel specifications based on Samsung 75" Model #QM85F Commercial Grade Professional Display. Any suggested Flat Panel equivalent must contain all input/output connections; display shall provide as good or better minimum brightness, contrast ratio, native resolution and maximum display colors as the specified Flat Panel. Models not currently in production (discontinued) at the time of the submittal, will not be considered. **Flat Panels must have a minimum of (2) HDMI and (1) DisplayPort Inputs**

2.20.5 All LCD LED Flat Panels shall be commercial grade monitors and shall be provided with a minimum four (4) year manufacturer warranty Plus any pre-specified Service Contract. Consumer grade flat panels will not be acceptable as an alternate.

2.21 Color of plates is to be confirmed by the Contractor prior to installation. Refer to the AV wiring diagram for input locations and wallplate requirements.

2.22 Contractor shall provide and install all wiring and components required per the detail drawings and specifications.

2.23 Flat Panel shall be provided with a 2-Port data connection installed by Division 27 10 00 Contractor behind the Flat Panel. Coordinate location of data outlet with 27 10 00 Contractor. Refer to the Detail Drawings for additional requirements.

2.23.1 Contractor shall furnish and install Category-6 data patch cable from the Flat Panel Data Outlet to the Flat Panel Ethernet Port. See AV Patch Cables section for requirements.

2.24 Contractor shall furnish and install a commercial grade Large Flat Panel Display with Soundbar and components as shown in the A/V system details and specifications. System shall consist of components that will use the Flat Panel as the audio-visual switch. All video inputs shall be directly wired to the Flat Panel. Audio shall be routed as shown in the AV Wiring Diagrams, in the detail drawings, to allow the Amplified Soundbar to serve as a system-wide audio amplification device. Refer to the detail drawings for additional installation configuration requirements, mounting systems and additional parts.

2.24.1 The Flat Panel mounting height shall be as shown in the drawing details must be field verified by the Contractor prior to the rough-in stage of the project. No flat panel mounts may be roughed-in until the locations and heights are confirmed.

2.24.2 The Large LED Flat Panel Display shall be mounted on the wall at the location shown on the floor plans and the Amplified Soundbar shall be suspended below the Flat Panel Display. The Soundbar shall move with the Flat Panel when adjusted away from the wall. Field verify the exact position of the Flat Panel Display and Soundbar with the District Project Manager prior to installation.

- 2.24.3 Provide Flat Panel Displays with a Recessed type wall mount by Chief Model #PNRIWUB mount with Model #PAC501B backbox, dual arm support as shown on the drawing details. Refer to the detail drawings for the flat panel mounting, outlet requirements and conduit requirements. Contractor shall furnish the adapter plate from Chief to mount to the model of flat panel provided.
- 2.24.4 The backbox for the recessed Flat Panel mount shall be furnished by the 27 20 00 Contractor and installed by the Division 26 Contractor. The backbox must be framed into the wall. The height of the backbox shall be installed as shown in the detail drawings. Flat Panel Monitor heights must be shown on the shop drawing submittal by the Contractor. Exact height of the flat panels must be field verified by the 27 20 00 Contractor prior to rough-in.
- 2.24.5 The 27 20 00 Contractor must coordinate with the Division 26 Contractor for the proper timing of the ordering and delivery of the backboxes (Chief PAC501B) for the recessed Flat Panel mounts. The Audio-Visual Contractor must provide the backbox to the Electrical Contractor during the rough-in phase of the construction project, with delivery to the job site no later than two weeks before the Rough-In date shown in the Construction Schedule. Coordinate the provision of the backboxes with the Construction Manager and the Electrical Contractor.
- 2.24.6 The final location of the Soundbar shall be determined by any clearance required to access any controls or connections on the Soundbar and clearances required to make adjustments (Pan, Tilt and Extension) to the Flat Panel. The Soundbar shall be located as close to the bottom of the panel as possible to lessen the exposed cable connections.
- 2.25 Provide an Amplified Soundbar System at the LED Flat Panel Display for audio support. See the detail drawings and diagrams for additional requirements. The Amplified Soundbar System shall be provided the following;
- 2.25.1 The Soundbar shall be hung from the VESA wall mount bracket on the back of the Flat Panel, directly below the flat panel display. Provide a Universal Soundbar adapter bracket to hang the Soundbar. Refer to the manufacturer's installation instructions for requirements for mounting the soundbar. The soundbar shall be mounted with enough clearance to allow the full vertical adjustment of the wall mount bracket and for access to the connection ports on the Soundbar. The Soundbar shall be securely attached to move with the Flat Panel when it is adjusted out or away from the wall. Provide Universal Soundbar Bracket Model #OCSBA (Or Approved Equal).
- 2.25.2 Connect the Flat Panel Display 3.5mm Stereo Audio Output to the 3.5mm Audio Input on the soundbar. Provide 3.5mm stereo audio connection patch cable to the Soundbar.

- 2.25.3 Soundbar shall be provided with built-in Subwoofers, Rated Output 100 Watts (2X20W Front L/R; 60W Built-in Sub); Bluetooth Input Technology, HDMI Input with ARC, 3.5mm Audio Input, (2) Optical Audio In; Less than 4" in Depth.
- 2.25.4 The Soundbar shall be as manufactured by Yamaha Model #SR-C20A (or Approved Equal) The Soundbar's volume shall be controlled with the original Yamaha remote control supplied with the Soundbar.
- 2.25.5 Install the Yamaha MusiCast APP for the Soundbar on the Coach's Computer and/or Tablet/Smart Phone device. The Soundbar's Bluetooth connectivity shall be programmed by the Contractor.
- 2.26 Provide surge suppressor installed behind the flat panel location for the TV and devices installed at the flat panel. Surge suppressor shall be rated for 15A, six outlets, and shall have outlet sections that swivel. Provide Cyber Power Model #CSB600WS.
- 2.27 Passive Local Origination Wall Plate; The wallplate will serve as the Main Input location to the Conference Room Flat Panel system and the Floor Box will serve as the Secondary Input location. Provide all patch cables for the system. See Passive Flat Panel A/V Diagram for wall plate requirements. Provide the following interfaces at the wallplate location;
 - 2.27.1 Provide (1) Single Gang wallplate at the Input location (Shown as the "LO" symbol on the drawings). Provide (1) HDMI with audio passive feed-through digital input wallplate Extron Model #WPD-110A on a Single Gang Decora Style faceplate at Interface (LO) Input wallplate location. Refer to the AV Wiring Diagrams for additional requirements.
 - 2.27.2 Provide (1) Single Dual Gang wallplate at the Flat Panel location (Shown as the "FP" symbol on the drawings). Provide (1) HDMI with audio passive feed-through digital input wallplate wallplates Extron Model #WPD-110A on a Single Dual Gang Decora Style faceplate at Flat Panel (FP) wallplate location. Refer to the AV Wiring Diagrams for additional requirements.
 - 2.27.3 Provide (1) HDMI Cable and (1) 3.5mm Unbalanced Audio Cable from the Passive HDMI Input Wallplate at the "2P/LO" location to the Passive HDMI Output wallplate behind the Flat Panel "FP/2P" as shown on the Flat Panel AV System Diagram.
 - 2.27.4 Provide (1) HDMI Patch Cable and (1) 3.5mm Unbalanced Audio Patch Cable from the pass through HDMI Output wallplate to the Flat Panel's Inputs on the back of the display. The HDMI Cable shall be directly connected to HDMI Input #1 on the Flat Panel and 3.5mm audio cable shall be directly connected to the 3.5mm Audio Input #1 on the Flat Panel. Provide cables as shown in the patch cables section of this specification.
 - 2.27.5 Contractor shall furnish and install (1) 12-Foot High Speed 90° Swivel-Type HDMI patch cable to the Instructor's Laptop or PC. The 90° HDMI end of the patch cable shall be connected to the faceplate to allow the cable to drop straight

down along the wall. Refer to the patch cable section for the exact patch cable requirements.

- 2.27.6 Contractor shall furnish and install (1) 12-Foot 3.5mm Audio patch cable to the Instructor's Laptop or PC. Refer to the patch cable section for the exact patch cable requirements. Audio patch cable is for playback of local devices.
- 2.27.7 Provide an HDMI (Female) to DisplayPort (Male) adapter for the Flat Panel System. The adapter shall be provided with the HDMI and Audio patch cable assemblies.
- 2.27.8 All wallplates shall be the Extron Decora style. Color of plates is to be confirmed by the Contractor prior to installation

Portable ADA Assistive Listening System

- 2.28 The Assisted Listening System shall be furnished and installed to meet CBC Section 11B-219 and comply with CBC Section 11B-706 and the ADA requirements for hard-of-hearing. Contractor shall furnish (1) Portable ADA Assistive Listening Systems Kit that may be used for Classrooms or other meeting spaces.
 - 2.28.1 Per ADA Assistive Listening System CBC Section 11B-706.3 – “The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing aid compatible.”
 - 2.28.2 The Grossmont UHSD has determined that a portable ADA Assistive Listening System shall be provided for the installed Audio-Visual Systems. Contractor shall provide the ADA Systems as shown in the project specifications.
 - 2.28.3 Provide for each Kit; A self-contained portable wireless FM transmitter and receivers inside a self-contained carrying case. Portable ADA Assistive Listening system shall be as manufactured by Williams Sound Corporation, Phone 1-800-843-3544. Provide self-contained FM based system Model #FM ADA Kit 37 RCH.
 - 2.28.4 Kit Contains; (1) PPA T46 transmitter, (4) PPA R37 receivers, (4) HED 027 headphones, (1) MIC 090 Mini Lavalier microphone, (1) MIC 049 conference microphone, (1) CCS 029 carrying case, (1) NKL 001 neck loop receiver, (1) ADA wall plaque and (5) BAT 026-2 “AA” batteries.

Audio/Video Patch Cables

- 2.29 All patch cables must be factory manufactured. All patch cables shall be in a length as required to provide the proper operation of the equipment, unless otherwise noted. Contractor is responsible for confirming all connector gender requirements prior to ordering.
- 2.30 Audio Patch Cables 2-feet to 25-feet in length for Installation Connections; All 3.5mm stereo audio cable assemblies shall be a male to male cable fully shielded cable with

3.5mm bayonet style connectors. Extron Mini Audio Cables Series (Or Approved Equal). Provide minimum length of 2 feet.

- 2.31 Audio Patch Cables 12 feet in length for Input Wallplate Connections; All 3.5mm stereo audio cable assemblies shall be a male to male cable fully shielded cable with 3.5mm bayonet style connectors. Extron Mini Audio Cables Series (Or Approved Equal). See the AV System Diagrams in the drawings and AV Input Wallplate requirements in the specifications for further instructions.
- 2.32 HDMI Cable Assemblies 12 feet in length for Input Wallplate Connections; All HDMI patch cables must be 4K/30 verified and must conform to the HDMI Premium and High Speed cable standards. Cables shall be furnished with 90° swivel head design, Vanco Pro Digital High Speed HDMI Swivel Cable Model #299012 (Or Approved Equal), UL and CL3 rated. See the AV System Diagrams in the drawings and AV Input Wallplate requirements in the specifications for further instructions.
- 2.33 HDMI Patch Cables 1.5-feet to 15-feet in length for Installation Connections; All HDMI patch cables must be 4K verified, ultra-flexible construction and must conform to the HDMI High Speed cable standards. Patch cable shall be Extron HDMI Ultra Series High Speed patch cable assemblies (Or Approved Equal). Length of patch cable shall be as required for proper operation.
- 2.34 Fiber Optic/Copper Hybrid HDMI Cable Assemblies 33-feet to 66-feet in length for Installation Connections; All HDMI patch cables must be 4K/30 verified and must conform to the HDMI Premium and High Speed cable standards. HDMI cable assemblies must be a Fiber Optic/Copper Hybrid construction with detachable ends. Cables shall be Hall Research CHD-DE* 4K Javelin™ Active HDMI Cable w/Detachable Ends or Kramer CP-AOCH Series High Speed. Length of patch cable shall be as required for proper operation.
 - 2.34.1 HDMI cable assembly must be installed with the manufacturer furnished “cable pulling sock”. Damaged or inoperable cable assemblies due to improper installation procedures shall be replaced by the Contractor at no expense to the District. Please note Manufacturer’s Cautionary Warning on product specification sheet – “DAMAGED DUE TO CONNECTOR BEING PULLED HARDER THAN 20 kg, IS NOT COVERED BY WARRANTY - To pull cable through conduits or tight spaces, never grab the connector, as it is easy to exceed the force limit on the connector, instead, remove the detachable end, protect the connector using a cable pulling sock and make sure the force is applied directly to the cable jacket.”
- 2.35 Category-6 Patch Cables 25-feet or Less; Category-6 UTP patch cables shall be as manufactured by Commscope in the color as shown on the Color Chart in the Detail Drawings.
- 2.36 All patch cables shall be provided for each type of connection required to provide a complete and operational system. All patch cables shall be factory manufactured).

- 2.37 All patch cables shall be provided for each type of connection required to provide a complete and operational system. All patch cables shall be factory manufactured.

Training

- 2.38 Portable Equipment shall be furnished and spares supplied to the designated representative of the Client, along with complete documentation of the materials provided. Where applicable, deliver portable equipment in the original manufacturer's supplied packaging.

- 2.39 **Contractor will provide a minimum of 4 clock hours of on-site training for site staff on the Classroom A/V systems.** Training for personnel shall be provided by certified technology specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, media retrieval procedures as well as operation procedures for local control configurations. The contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and Owner's representative.

2.39.1 Training for staff will include basic system concepts. Faculty and staff will need to know how to power on/off the system, and how to access one or more media resources via remote control. Training should include use and operation of audio/video devices and techniques and trouble-shooting tips. Trainers should incorporate hands-on techniques to maximize staff opportunity to incorporate and develop curriculum that is both meaningful and targeted for their student needs. Clearly written support materials should be provided to all training participants. Manual describing operation and use of the system shall also be provided.

PART 3 - INSTALLATION AND EXECUTION

- 3.1 Verify that all electrical requirements including junction boxes, empty conduit and power circuits and receptacles are in place as shown on the drawings.
- 3.2 Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the owner's representative. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.
- 3.3 Installation practices shall follow "standard broadcast wiring" and installation practices, as excerpted from "Recommended Wiring Practices, "Sound System Engineering", (2nd Edition) D. Davis, and Performed to the highest standards of acknowledged industry practices. Upon request the A/V contractor shall furnish all equipment and labor to verify the compliance with the following:

Optical:

- 3.3.1 Center to corner light fall off shall be less than 50% for video/data projectors.
- 3.3.2 Center to corner light fall off shall be less than 35% for optical projectors.
- 3.3.3 Images shall be level and square with the appropriate aspect ratio.
- 3.3.4 Image shall be free from visible vibration.

Audio System:

- 3.3.5 Signal-to-noise ratio (including crosstalk): 55-dB minimum.
- 3.3.6 Total harmonic distortion: 0.1% maximum from 30 Hz to 15,000 Hz.
- 3.3.7 System frequency response: ± 1.0 dB, 20 Hz to 20,000 Hz.
- 3.3.8 Program reproduction system with point-source loudspeakers: Flat response from 63 Hz to 2.5 kHz ± 2 -dB, decreasing uniformly from a relative level of 0-dB at 2.5 kHz to a relative level of -10 -dB at 10 kHz as measured on axis of loudspeaker.
- 3.3.9 Sound output capability: Program levels of not less than 100 dB without objectionable distortion, rattles, or buzzes.
- 3.3.10 Hum and noise is inaudible (below the background noise level of the space) under normal operation and as observed in normal seat locations.

Video System:

- 3.3.11 Signal-to-noise ratio (peak to RMS, unweighted DC to 4.2 MHz): 55-dB minimum.
- 3.3.12 Crosstalk (unweighted DC to 4.2 MHz): 45-dB minimum.
- 3.3.13 Frequency response: ± 0.5 dB to 4.2 Mhz.
- 3.3.14 Line and field tilt: 2% minimum.
- 3.3.15 Differential gain: 3% maximum.
- 3.3.16 Differential phase: 2° maximum.
- 3.3.17 System timing sync coincidence: within 50 nanoseconds.
- 3.3.18 Color timing: $\pm 2^\circ$ at 3.58 Mhz.

Radio Frequency (RF) System:

- 3.3.19 Visual Carrier level: +0 dBmV minimum and +16 dBmV maximum at system outlets for utilized channels.

- 3.3.20 Adjacent Channel Visual Carrier: 3-dB maximum differential at system outlets.
- 3.3.21 Non-adjacent Channel Visual Carrier: 0-dB maximum differential at system outlets.
- 3.3.22 Carrier-to-Noise Ratio: 42-dB minimum
- 3.3.23 Amplitude Response: Flat \pm 1.0 Db
- 3.3.24 Signal-to-Noise Ratio: 45-dB minimum for the maximum level of the signal and the interference resulting from cross modulation from other signals on the system, after demodulation.
- 3.3.25 Outlet-to-Outlet Isolation: 25-dB minimum.
- 3.4 Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.
- 3.5 Where manufacturer does not provide bending radius information, minimum bending radius shall be 10 times cable diameter. Arrange and mount equipment and materials in a manner acceptable to the engineer and the owner.
- 3.6 Attach cables to permanent structure with suitable attachments at intervals of 48 to 60 inches. Support cables installed above removable ceilings. Install adequate support structures for 10 foot cable service loops at each TC.
- 3.7 Mark all cables and patch cords or jumpers with permanent, non-handwritten number or letter cable markers within six inches of both ends. All cables shall be marked. Cable marking codes shall correspond to run sheets.
- 3.8 All faceplates shall be labeled with type-written permanent labels securely attached to the faceplates identifying all A/V connections. (ie; Doc Cam, PC, DVD, etc.) Cables at the projector and A/V switch shall be also be labeled to match the faceplates.
- 3.9 Furnish screw-type terminal blocks, boards, strips or connectors for cables that interface with racks, cabinets, consoles or equipment modules. Attach wires terminating at screw-type terminals with crimp-on lugs. "Telephone-style" punch down blocks are not acceptable for signal or data wiring.
- 3.10 Group cables according to signals being carried. To reduce signal contamination, form separate groups for the following:
 - 3.10.1 Power cables.
 - 3.10.2 Control cables.
 - 3.10.3 Video cables.
 - 3.10.4 Camera cables.
 - 3.10.5 Audio cables for signals less than minus 20 dBm.
 - 3.10.6 Audio cables for signals between minus 20 dBm and plus 30 dBm.
 - 3.10.7 Audio cables for signals above plus 30 dBm.

3.10.8 Broadband RF cables.

- 3.11 Run power cables, control cables, and high level cables on the left side of an equipment rack as viewed from the back. Run other cables on the right side of an equipment rack.
- 3.12 Cut cables (except video, camera and RGBS cables, which must be cut to electrical length) to the length required by the run. All wire and cable shall be continuous and splice-free for the entire length of run. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of appropriate length.
- 3.13 Install no cable with a bend radius less than that recommended by the manufacturer.
- 3.14 Provide strain relief for cables. Provide connectors with metal shell/casings. Provide a minimum of three feet of free cable coiled in a floor pocket. Use spiral wrap to group similar cable types.
- 3.15 All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels, or equipment enclosures. Tin all terminated shield drain wires and insulate with heat-shrink tubing.
- 3.16 Land all field loudspeaker wiring entering each rack at terminal devices prior to connection to equipment or devices. Land loudspeaker level control cables at screw or tubular clamp type barrier blocks on the left side of the equipment rack as viewed from the rear. Make all connections to screw-type barrier blocks with insulated crimp-on spade lugs. Size all lugs properly to assure low-resistance connections.
- 3.17 Separately dress, route and land microphone and line level cables directly to equipment.
- 3.18 Use only rosin core 60/40 tin/lead solder for all solder connections.
- 3.19 All cables shall be neatly labeled with wrap around type written labels.
 - 3.19.1 On the cable at the rear of the faceplate or termination location at the control location. Requires the use of a self laminating wrap around label. Brady Label self laminating 1.2" by 1.5" wrap around label Part # 29689 (NO ACCEPTABLE EQUAL)
- 3.20 Lace, tie or harness wire or cable in accordance with accepted professional practice. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Provide service loops where harness of different classes cross or where hinged panels are to be interconnected.
- 3.21 Upon completion of the work, remove all refuse and rubbish from and about the premises, and leave the relevant areas and equipment clean and in an operational state.
- 3.22 During the installation, and up to the date of final acceptance, protect finished and unfinished work against damage and loss. In the event of such damage or loss, replace or repair such work at no cost to the owner.

- 3.23 Prior to final acceptance, provide minimum of three complete sets of drawings showing all cable numbers and construction details in accordance with the actual system installation. Revise the device layout drawings to represent actual installation locations and coordinate these with the electrical contractor. The operation manual shall contain all instructions necessary for the proper operation of the installed system and manufacturer's instructions. The maintenance manual shall contain all information required for the "proof of performance" as required and all manufacturers' maintenance information.

Inspection and Test upon Completion

- 3.24 Check out and final connections to the system shall be made by the Contractor of the products installed. Technicians shall demonstrate operation of the complete system and each major component to the Owner.
- 3.25 System field wiring diagrams shall be provided to the owner by the system Installer (Contractor) prior to completion of the installation.
- 3.26 All materials and installation shall be guaranteed to be free of defects in material and workmanship for two years after final acceptance of installation and test.
- 3.27 Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational and maintenance manuals have been received.
- 3.28 The Contractor shall be responsible to provide service within 24 hours (or by mutual consent) after notification by the Owner or his representative, within the hours of 8:00 AM to 5:00 PM from Monday through Friday. Service request forms shall be supplied by the Contractor and the faxing or mailing of such a request form shall constitute notification by the Owner of a service request.
- 3.29 The Contractor shall provide two "preventative maintenance" service calls, spaced six months apart, for cleaning of all source devices and overall inspection of the system.

PROJECT CLOSEOUT

- 3.30 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this division, in accordance with these specifications and as described below.
- 3.31 Equipment Lists and Maintenance Manuals:
- 3.31.1 Prior to completion of job, contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this section of the specifications:
- 3.31.1.1 Name, model, and manufacturer.

- 3.31.1.2 Complete parts drawings and lists.
 - 3.31.1.3 Local supply for parts and replacement and telephone number.
 - 3.31.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.
- 3.32 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

RECORD DRAWINGS

- 3.33 The contractor shall maintain record drawings as specified in accordance with these specifications, and as noted below.
- 3.34 Drawings shall show locations of all concealed and exposed conduit runs, giving the number and size of conduit wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all the actual changes made.
- 3.35 One set of record drawings shall be delivered to the Engineer in accordance with these specifications.

END OF SECTION

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SECTION 27 30 00
NETWORKING ELECTRONICS

PART 1 – GENERAL

- 1.1 Include all labor and necessary consumable materials for providing installation of the network electronics and the wireless access points as described therein. This specification is for a single building on an existing campus and shall designate additional network electronics to be installed in addition to the existing system components.
- 1.2 Quality Assurance
 - 1.2.1 Manufacturers' qualifications: All components furnished by the District shall be as manufactured by a single manufacturer. **Acceptable manufacturers shall be "Cisco." All network electronics and wireless access points shall be furnished by the District and installed by the Contractor.**
 - 1.2.2 Equipment qualifications: It is the intent of these specifications that each bidder provide installation of all hardware, components and services that are necessary to ensure a fully operational networking system within the scope of the project.
 - 1.2.3 Warranty: Installation shall be warranted by the Contractor to the school district for a period of 3 years after District acceptance and sign-off of the completed system. (unless otherwise noted in the specifications)
- 1.3 In order to ensure project cohesion, a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all labor and supplies; miscellaneous materials; and training. The Contractor will perform all operations necessary for the "TURNKEY" and fully completed installation in accordance with the specifications herein. As such, the successful contractor must be factory trained on all aspects of system hardware.
- 1.4 Submittal shall be made **within (10) working days** after the award of the contract by the District. This submittal shall include the following:
 - 1.4.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:
 - 1.4.1.1 Description and quantity of each item.
 - 1.4.1.2 Manufacturer's Name and Model Number.
 - 1.4.1.3 Manufacturer's Specification Sheet.
 - 1.4.2 Include with submittals all warranty information and a description of support and maintenance services to be provided. Also include all licenses and maintenance agreements required for continued operation of the equipment.

PART 2 – PRODUCTS

- 2.1 The District shall furnish all network electronics and mounting hardware for the equipment racks. The Contractor shall furnish all miscellaneous materials such as racks screws, Velcro ties, labels, etc. for installation of the network electronics in the rack.
- 2.2 The District shall furnish all wireless access points. The Contractor shall furnish and install all mounting hardware, including the “doghouse” wall mount supports, Oberon Model #1011-00 or approved equal. Refer to the drawing details for installation requirements.
- 2.3 The District shall provide all programming of the network electronics and wireless access points and controllers.
- 2.4 Provide all set-up and staging of all new network switches. District shall retain all rights to the programming and software upon installation. Provide installation of the District’s bar-coded asset management stickers to be placed on each network switch. District shall provide asset management stickers to the Contractor along with installation instructions. All work in relation to the cut-over shall be completed after normal operating hours at the District Office. Any scheduled down-time must occur on the weekend or other normal non-working hours or days approved by the District. Contractor shall be responsible for insuring the users do not suffer down-time.
 - 2.4.1 All switches shall be furnished by the District with the necessary stacking cables, GBIC Modules, rack mount brackets, etc. The Contractor shall install all of these components in the IDF closet.
 - 2.4.2 Contractor shall be responsible for the installation and connection of the network switches. Contractor shall install all UTP patch cords for outlet connections and fiber backbone connections to the network switches from the patch panels. The UTP and fiber optic patch cords shall be furnished by the 27 10 00 Contractor. Coordinate the receipt of the patch cords with the 27 10 00 Contractor.
 - 2.4.3 Follow the color coding shown in the drawing details for all patch cord installation. Coordinate with the District for switch port assignments and fiber backbone port connections to the MDF Room and the main switch chassis.
- 2.5 The District NOC location has existing wireless controllers. The District will be responsible for programming the controllers and providing the licenses for the WAPs.
- 2.6 Contractor shall be responsible for the installation and connection of the wireless access points. Location of access points is shown on the construction drawings. WAPs (Wireless Access Points) shall be provided for interior coverage. All interior access points shall be installed below the accessible ceilings or wall mounted as shown on the floor plans. Contractor shall install all UTP patch cords for connection to the network switches. The patch cords shall be furnished by the 27 10 00 Contractor. Coordinate the receipt of the

patch cords with the 27 10 00 Contractor. See Installation section for labeling requirements.

2.6.1 The Contractor shall test and confirm configuration of the WAPs installed for the new project work. Refer to the drawings for locations of WAPs.

2.6.2 Install (Black) Category-6 (WAP End) patch cords with pre-molded boot at the WAP locations per the drawing details. Install the (Black) Category-6 (Patch Panel End) patch cords with pre-molded boot at the WAP locations. Coordinate with the District the ports on the POE switches to be designated for the WAP locations.

2.7 The following items **are existing** at each location.

2.7.1 Data Infrastructure cabling and support systems Furnished and installed by the 27 10 00 Contractor.

2.7.2 Category-6 Modular Patch Panels Furnished and installed by the 27 10 00 Contractor.

2.7.3 19" wide equipment racks or cabinets and wire management systems Furnished and installed by the 27 10 00 Contractor.

PART 3 – INSTALLATION

3.1 Provide installation of wireless access points in the new project area. The following services shall be provided;

3.1.1 Provide Installation of all wireless access points and new network electronics including configuration and documentation. The Contractor shall provide the District a record set of “Key Sheets” indicating the following items for each port in the network used for activation of the new WAPs on the new and existing switches; Room Number, Device Type, IP Address, MAC Address, Wall Plate Label, Switch Number, Switch Port Number, and Label Description. See the example below:

Room #	Device	IP (Static)	MAC	WallJack Label	Switch #	Switch Port		IDF#
								Switch # - (From top to bottom - 1,2,3, ...- use A,B,C.. in label) Switch Port - (1 - 48)
2014	Extron	10.63.155.159	0000.0322.a32b	A1-A04	1	4	Example	IDF A1 -- Top Switch (A) -- Port 4
123	Extron	10.63.155.152	0000.0322.aabb	C1-B24	2	24	Example	IDF C1 -- 2nd Switch down In stack (B) -- Port 24
2201	Cisco AP	dhcp	0012.aaaa.12ab	A2-C35	3	35	Example	IDF A2 -- 3rd Switch down in stack (C) -- Port 35
2202	<device>	dhcp	0012.aa4a.12ab	A2-C36	3	36	Example	IDF A2 -- 3rd Switch down in stack (C) -- Port 36

3.1.2 Contractor shall install the WAPs below the ceiling in locations that have accessible ceiling tiles. The ceiling spline directly next the access point shall be labeled with a permanent label, with the exact designation to be determined by the District IT Department. Coordinate with the District IT Department for the labeling requirements prior to installation.

- 3.1.3 The Contractor will label all access points with the patch panel port ID number, IP Address and unique network ID name on the back of the access point with permanent, type written labels. Provide laser printer type, Brady Labels Part #LAT-24-747-1, white matte color. No approved equal.
 - 3.1.4 Testing, programming and configuration of all systems and devices provided for the site.
 - 3.1.5 All extended Warranties on all equipment shall be furnished by the District.
 - 3.1.6 All other required labor and miscellaneous services to provide a complete turn-key installation.
 - 3.1.7 Coordination of all efforts with the District's Construction Management Team and District IT Department. The Contractor shall be responsible for providing schedules of installation timelines, equipment receiving dates, confirmation of state of materials delivered to the site to insure that only new, undamaged, materials and equipment are received. Contractor shall also be responsible for meeting the Construction Schedule dates so as not delay the project in any way, shape or form. All materials shall be ordered to meet the installation deadlines.
 - 3.1.8 Contractor shall also include follow-up services as shown in the specifications in the Testing and Training Section.
- 3.2 The minimum bending radius for all new cables and the maximum pulling tension shall not exceed manufacturer's recommendations. All cables shall be routed through vertical and horizontal wire minders to provide a neat workmanship-like installation.
 - 3.3 Each new piece of electronic equipment must be securely fastened into the equipment rack, connected to all networking and power sources per manufacturer's recommendations.
 - 3.4 The installation of all software configuration of all new electronic components and programming on the electronic components shall be provided by the District. Coordinate with the District IT Department to gather information on the existing configurations to bring the new equipment in line with the existing equipment that is currently in operation. The users shall not experience any loss of service due to the upgrades or replacement of equipment.

PART 4 - TESTING AND TRAINING

- 4.1 All electronic equipment shall be tested to comply with the manufacturers instructions. Upon completion, the contractor shall provide written verification that all components have been installed and are operating per the manufacturers instructions.

- 4.2 Manuals: Three copies of an operation manual must be supplied with each piece of equipment.

END OF SECTION

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SECTION 28 01 00
ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

ARTICLE 1 - SUMMARY

- 1.1 This Division of the specifications outlines the provisions of the contract work to be performed as a subcontract under the Division 26 scope of work. Reference the Division 26 Electrical General Provisions for scope of work and general requirements.

- 1.2 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under Division 1 requirements.

END OF SECTION

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SECTION 28 13 00
SECURITY SYSTEM

PART 1 – GENERAL

- 1.1 Furnish all materials, equipment and labor, and perform all operations in connection with systems work as indicated on the drawing, as specified herein and required to complete the work.
- 1.2 Related Specification Sections:
 - 1.2.1 Division 26 05 33 – Conduit and Fittings
 - 1.2.2 Division 26 05 19 – Conductors
 - 1.2.3 Division 26 05 34 – Outlet and Junction Boxes
- 1.3 All security system components shall be manufactured by and wiring shall be furnished and installed by a factory authorized contractor and distributor. The Contractor shall hold a license from the State of California for the purpose of installing security systems.
- 1.4 The contractor shall be regularly engaged in the installation and repair of the type of equipment to be installed.
- 1.5 The conduit, outlets, terminal cabinets, device backboxes, etc., which form a part of the rough-in work, shall be furnished and installed complete by the Contractor. Security system components as listed under products shall be furnished and installed by the authorized subcontractor.
- 1.6 The subcontractor shall furnish all equipment, accessories and material required for the complete installation of a security system in accordance with specifications and as shown on the drawings. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification. The distributor must also provide complete installation of all wiring and devices or equipment. Supervised installation for the wiring and devices shall be permitted with the following conditions:
 - 1.6.1 A letter will be required from the security system manufacturer's representative certifying that the cable installation was completed in compliance with the manufacturer's recommended installation requirements.
 - 1.6.2 The cables shall be tested in the presence of the manufacturer's representative. These tests will then be submitted to the electrical engineer.
 - 1.6.3 The security system shall be warranted by the manufacturer's representative per the contract agreement.
- 1.7 Phase I Submittal shall be made **within (20) working days** after the award of the contract by the District. This submittal shall include the following:

- 1.7.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:
 - 1.7.1.1 Description and quantity of each item.
 - 1.7.1.2 Manufacturer's Name and Model Number.
 - 1.7.1.3 Manufacturer's Specification Sheet.
 - 1.7.1.4 Description of any specialty backbox requirements.

1.8 Common submittal mistakes which will result in submittals being rejected:

- 1.8.1 Not including the qualifications of the installing contractor.
- 1.8.2 Not including all items listed in the above itemized description.
- 1.8.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting underlining or clouding the items to be reviewed, r crossing out the items which are not applicable.

PART 2 – PRODUCTS

2.1 Building Security System

2.2 Control Panel

2.2.1 The Control/Communicator panel is an existing **Detection Systems Inc. Series.**

2.3 Provide a complete and operable supervised intrusion detection system as shown on the plans including, but not limited to, , keypad stations, motion detectors, door switches.

2.3.1 Upon detection of an intruder by initiation of any device in the system, the system shall cause alarm information to be sent by digital dialer to central station alarm monitoring agency.

2.3.2 System detectors located in areas provided with keypad control shall be programmed to have a 30 second entry delay.

2.3.3 Two (2) existing keypads shall be removed and re-installed and re programmed by the contractor.

2.3.4 Each relocatable shall be wired as a separate zone with all detectors within that zone controlled separately.

2.4 Alarm information shall be sent by digital dialer to a central station alarm monitoring agency.

- 2.5 Systems shall detect the entry and/or the motion of a body taking not more than four steps in an area secured with motion detection equipment where entry doors or windows are possible access.
- 2.6 System shall be zoned with each building controlled separately so that portions of the facility may be secured while others remain unsecured. All zones shall be able to be armed or disarmed from the master keypad in the administration building.
- 2.7 Motion sensors are existing to be removed and re-installed and programmed by the contractor. Provide new wiring as required.
- 2.8 Provide new door contacts to be furnished and installed by the contractor, provide new wiring as required.

PART 3 – EXECUTION

- 3.1 All connections throughout the system shall be soldered, crimped by means of AMP lugs, fastened with screw type terminals, made by spring tension clip "punch block" terminals or made by standard plugs and receptacles. Each wire twisted pair or cable shall be tagged throughout the site with EZ markers with the room number it serves. All conductors in terminal cabinets shall be carefully formed and harnessed in a workmanlike manner.
- 3.2 All security system cabling shall be installed in conduit where indicated on the drawings or where routed exposed and shall be open wiring where routed above accessible ceilings or in walls.
- 3.3 Locate motion sensors on walls to provide optimum coverage of the space and to not conflict with the architectural aesthetics of the building. Locations of motion sensors as shown on the electrical plans are diagrammatic only.
- 3.4 Final System Acceptance
 - 3.4.1 The system will be accepted only after a satisfactory test of the entire system has been accomplished by a Factory-Trained Distributor in the presence of a representative of the authority having jurisdiction and the Owner's representative. This contractor shall provide all personnel, ladders and testing equipment to assist the local authority in completing this test. Actuate each device and verify that the system performs as specified.
 - 3.4.1.1 Provide a minimum of one (1) two-hour training period located at the project site, to instruct District personnel in proper operation of all systems.
 - 3.4.1.2 Provide a minimum of three (3) complete owner operation manuals for the district records.
 - 3.4.1.3 Provide a minimum of two (2) complete as built sets of drawings for the district records.

END OF SECTION

SECTION 28 30 01
FIRE ALARM VOICE EVACUATION SYSTEM

PART 1 – GENERAL

- 1.1 Work Included:
 - 1.1.1 Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating fire alarm system.

- 1.2 Related Work:
 - 1.2.1 Division 26 01 00: Electrical General Provisions
 - 1.2.2 Division 26 05 33: Conduit and Fittings
 - 1.2.3 Division 26 05 34: Outlet and Junction Boxes

- 1.3 The equipment and installation shall comply with the current applicable provisions of the following standards:
 - NFPA 72-2016. National Fire Alarm Code with California Amendments.
 - CBC - 2019. California Building Code (CBC), Part 2, Title 24, CCR.
 - CEC - 2019. California Electrical Code, (CEC), Part 3, Title 24, CCR.
 - CFC - 2019. California Fire Code (CFC), Part 9, Title 24, CCR.

- 1.4 The system and all components shall be listed by Underwriters Laboratories, Inc. for use in Fire Protective Signaling Systems under the following standards as applicable:
 - UL 38 Manually Actuated Signaling Boxes.
 - UL 50 Cabinets and Boxes.
 - UL 268 Smoke Detectors for Fire Protective Signaling Systems.
 - UL 268A Smoke Detectors for Duct Applications
 - UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
 - UL 464 Audible Signaling Appliances.
 - UL 521. Heat Detectors for Fire Protective Signaling Systems.
 - UL 864 Control Units for Fire Protective Signaling Systems.
 - UL 1481. Power supplies for Fire Protective Signaling Systems.
 - UL 1971. Visual Signaling Appliances.

- 1.5 Only Fire Alarm Control Panel Equipment and Peripheral Field Devices have been shown on the Contract Bid Single Line Block Diagram. Specific and complete wiring between Control Equipment and Peripheral Equipment has been deleted for clarity.

- 1.6 Submittal shall be made **in accordance with Division 26 01 00 – Shop Drawings and Submittals.** This submittal shall include the following:

1.6.1 Complete bills of quantities, including all materials, components, devices, wiring and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:

- 1.6.1.1 Quantity of each type of equipment item.
- 1.6.1.2 Quantities of 10% spare devices as per 1.16.
- 1.6.1.3 Description of each item.
- 1.6.1.4 Manufacturer's Name and Model Number.
- 1.6.1.5 Manufacturer's Specification Sheet.
- 1.6.1.6 Back box type and dimensions per device type.
- 1.6.1.7 California State Fire Marshall Listing Sheets for all components.
- 1.6.1.8 Equipment items which have individual components, will require that all component parts be listed individually.
- 1.6.1.9 Letter indicating the contractor's intent to comply with Phase II submittal drawings.

1.7 Phase II Submittal shall be provided **within (20) working days** after the approval of the Phase I submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD System. Each submission shall include 'D' or 'E' size print copies to match the contract drawings, and one (1) data disk copy with files in an AutoCAD 2000i or 2004 format. Building floor plan CAD files on disk, will be made available via express mail after the receipt of payment of \$50.00 per building floor plan, or \$300.00 minimum which ever is less. Contractor shall make the request for drawings in writing directly to Johnson Consulting Engineers, confirmation of the request and a release form will be forwarded to the contractor to include a signed copy with payment prior to release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the contractor.

1.7.1 **Provide complete shop drawings to include the following:**

- 1.7.1.1 Complete floor plans, at scale of contract documents, showing the locations throughout the project of all devices, panels conduits, wireways, tray, pullboxes, junction boxes, number and type of conductors, and other devices.
- 1.7.1.2 Point to point wiring diagrams showing wiring from panel terminals to each device.
- 1.7.1.3 Riser diagram indicating all wiring and circuits.
- 1.7.1.4 Current State Fire Marshal listing sheets for all components and devices.
- 1.7.1.5 Provide battery power supply calculations, indicate point of power supply connection, means of disconnect, over-current protection, etc. for each panel.

- 1.7.1.6 Provide detailed information on conductors to be used-
manufacturer, type, size, insulation, etc.
- 1.7.1.7 Provide voltage drop calculations for all conductor run is from each
panel (i.e., main FACP, remotes, power extenders, etc.) for each
panel.
- 1.7.1.8 Provide written sequence of system operation matrix.
- 1.7.1.9 Provide list of zones. (Every device that is addressable.)
- 1.7.1.10 Provide detailed drawing for annunciator panel indicating all zones
and initiating devices.

1.8 **Common submittal mistakes which will result in submittals being rejected:**

- 1.8.1 Not including the qualifications of the installing contractor.
- 1.8.2 Not including all items listed in the above itemized description.
- 1.8.3 Including catalog cut sheets which have several items on a page, and not clearly
identifying by highlighting, underlining or clouding the items to be reviewed, or
crossing out the items which are not applicable.
- 1.8.4 Not including actual manufacturer’s catalog information of proposed products.
- 1.8.5 Do not include multiple manufacturers for similar products and do not indicate
“or approved equal” statements, or “to be determined later” statements. The
products being submitted must be the products installed.
- 1.9 All equipment and material shall be new and unused, and listed by Underwriter's
Laboratories for the specific intended purpose. All control panel components and field
peripherals shall be designed for continuous duty without degradation of function or
performance. All equipment covered by this specification or noted on Installation.
Drawings shall be equipment suited for the application and shall be provided by a single
manufacturer or be recognized and UL listed as compatible by both manufacturers.
- 1.10 It will be the responsibility of the Contractor to ensure proper specification adherence
for system operation, final connection, test, turnover, warranty compliance, and after-
market service. The distributor of the equipment specified must be factory-trained and
certified.
- 1.11 Basic System Functional Operation, upon operation of any automatic, manual or other
initiation device the following shall occur:
 - 1.11.1 The system alarm LED shall flash.

- 1.11.2 A local piezo electric signal in the control panel shall sound.
- 1.11.3 A backlit 80-character LCD display shall indicate all information associated with the fire alarm condition, including the alarm point and its location within the protected premises.
- 1.11.4 History storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
- 1.11.5 All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- 1.11.6 LED display and audible signaling at the remote annunciator indicating building, fire zone, and type of device. Annunciator shall also provide a separate audible signal for CO detection with a green flashing light, with classroom number indication.
- 1.11.7 Automatic retransmission to a UL central station for fire department notification.
- 1.11.8 Automatic shut down of air conditioning units shall be performed by control modules at each unit when required as part of a complete area coverage design scheme. Each building shall shut down all A/C units and dampers within that building as one zone.
- 1.12 All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protective signaling system.
- 1.13 All equipment and components shall be installed in strict compliance with manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- 1.14 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.
- 1.15 All wiring shall be installed in a conduit system.
- 1.16 The contractor shall provide as a part of this contract additional control modules, heat detectors, smoke detectors, CO detector, duct detectors, manual pull stations, strobes, speakers, speaker/strobes exterior speakers devices etc. along with all required programming, to equal 10% of the total quantity of devices shown on the drawings, or a minimum of three (3) for each type, whichever is greater. Installation of 50' of conduit, boxes and all wiring for each of the devices shall be included, and required locations coordinated with CSFM final approved shop drawings. Any devices not required to be

included during construction shall be delivered to the District at the completion of the project. The quantities of these devices shall be listed as a part of the Phase I submittals.

- 1.17 The installing contractor shall provide a copy of current documentation, indicating that the contractor installing the fire alarm systems or devices and wiring, is certified by Underwriters Laboratories (UL) in its product directories under the listing category "PROTECTIVE SIGNALING SERVICES - LOCAL, AUXILIARY, REMOTE STATION, AND PROPRIETARY." The contractor shall be certified by the manufacturer to install and program the system. The contractor must also provide complete installation of all wiring and equipment, and software programming. Supervised installation of the wiring, devices and/or any software programming shall not be permitted.
- 1.17.1 The installing contractor must also be an "authorized dealer" by the equipment manufacturer and must have completed all required training prior to the bid of this project.
- 1.17.2 The fire alarm system installation shall be warranted by the manufacturer's representative.
- 1.17.3 The Contractor shall have a current California C-10 or C-7 Contractor's License, and all individuals working on this project shall have passed the Department of Industrial Relations Division of Apprenticeship Standards – "Fire / Life Safety Certification Program."
- 1.17.4 The installing contractor shall provide, at the time of submittal, a letter of intent to provide an extended service warranty. This warranty shall extend for a total of three (3) years, starting at the completion, testing, and training of this project. The service warranty shall cover all material and labor to keep operational all system devices installed under this project, and shall include two (2) complete U.L. system's tests and cleaning of all devices at year two (2) and year three (3) of the warranty. Routine cleaning of devices, other than at the two (2) specified U.L. system's testing periods, will not be included as a part of this warranty.
- 1.17.5 The installing contractor shall provide, at the time of submittal, a letter indicating that the installation crew for this project meets the following NICET certifications:
- 1.17.5.1 25% of the installing field personnel must have completed NICET Level 2 Certification.
- 1.17.5.2 One of the installing field personnel and /or supervisor must have completed NICET Level 3 Certification.
- 1.17.5.3 Contractor shop drawings shall be signed by an individual who has completed NICET Level 4 Certification.

- 1.18 All conduit and standard backboxes will be furnished and installed by the Division 26 Contractor. Specialty boxes will be furnished by the equipment supplier to be installed by the Division 26 Contractor.
- 1.19 Equipment and materials shall be the standard product of **FCI. To match the existing campus system**
- 1.20 Alternate equipment as manufactured by any other manufacturer not specifically listed above will not be approved for use on this project.
- 1.21 D.S.A approved drawings are included as a part of the drawing set.

PART 2 - PRODUCTS

- 2.1 Main Fire Alarm Control Panel:
 - 2.1.1 Fire alarm control panel shall is existing FCI E3
 - 2.1.2 The system shall be controlled and supervised by a microprocessor based monitoring fire alarm control panel. The systems shall be addressable, field configurable, programmable and editable. The system shall continuously scan devices for change of status. Each device shall have its own unique address, but shall also be grouped by building as a separate zone for remote annunciation and alarm report purposes.
 - 2.1.3 The fire alarm control panel shall be housed in a lockable, code gauge steel cabinet with 80character LCD display, master controller operators panel, indicating lamps, silence switch and reset switch mounted on cabinet front. The fire alarm control panel shall be physically and visually located in the general office for monitoring by staff, and shall sound the "Voice Message" in all zones. Signal duration shall be field programmable and initially set at three minutes. Provide all control modules, synchronous modules, etc., to provide a complete working system per all codes that apply.
 - 2.1.4 The fire alarm control panel shall come with standardized software for on-site customization of the system. The unit shall be capable of providing a 600-event historical log with zone or point selectable alarm verification.
 - 2.1.5 Provide a minimum 100 watts of amplification in each FACP with a minimum of 25% spare capacity.
 - 2.1.6 The unit shall support **a minimum of 3000 intelligent addressable points** and one output point, SPST contact per zone. Provide the number of modules necessary to control and supervise fire alarm devices as shown on the Drawings, as well as to provide 25% spare capacity.

- 2.1.7 The unit shall also provide a minimum of (2) class B strobe circuits with additional circuits as indicated on the drawings.
- 2.1.8 The fire alarm control panel shall be capable of providing a walk test.
- 2.2 The power feed for the FACP shall be 3-wire, 120volt, AC, single phase (20A circuit) permanently labeled "FIRE ALARM CONTROL POWER", terminating at the master fire alarm control and supervisory panel. The label shall be red with 1/4" high white lettering. The source circuit breaker must be provided with a lock-on device.
- 2.3 In addition to the AC circuit, the panel shall be equipped with a DC battery to activate an audible alarm and pilot light in case of a power failure on the AC circuit.
- 2.4 The master fire alarm panel shall be equipped with a manual pull lever type, supervised report station.
- 2.5 With the exception of the manually operated report station required at the master fire alarm panel and large assembly areas, the remainder of the school facility shall be equipped with approved, electronically supervised, automatic fire detection devices, such that every room, space, including concealed spaces, such as the attic spaces above ceilings, etc., is provided with approved coverage.
- 2.6 TRANSPONDER PANELS shall provide voice evacuation/annunciation with a minimum 100 watts of audio amplification to support 70v speaker devices and a minimum of (2) Class B Strobe NAC circuits and be fiber networked to the system. Provide for 25% additional capacity for amplification in each Transponder panel.
- 2.7 REMOTE POWER SUPPLIES shall provide a minimum of (4) Class B NAC circuits.
- 2.8 MANUAL FIRE ALARM STATIONS shall be addressable test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal, except by use of a key. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet, front or side. Manual stations shall be constructed of die-formed, satin-finished aluminum, with operating directions provided on the cover in depressed red letters. The word FIRE shall appear on each side of the stations in depressed letters, 1/2-inch in size or larger. Stations shall be suitable for semi-flush mounting on a standard single-gang box or switch plate, and shall be provided with a terminal block for connection of fire alarm system wiring. Manual pull stations must comply with CBC sections 11B-309 and 11B-403.
- 2.9 SPEAKER / STROBE DEVICE shall be of the semi-flush type designed for mounting to a standard 4 11/16" deep electrical back box. Each device shall be provided with a semi-flush accessory plate. Exterior speakers shall be weatherproof. The strobe unit shall have a meantime between failure (MTBF) of 1,000 hours or greater. The strobe section shall have a minimum flash rate of approximately one flash per second, with candela rating as per UL standard 1971. Housing shall be white.

- 2.9.1 In areas containing two or more audible devices, or three or more visual devices, these devices shall be synchronized, Per NFPA 72, Chapter 18 California Amendments (2016).
- 2.10 SPEAKERS shall operate at 70 VRMS and provide tap setting from 1/8 to 2 watts and provide efficient design for high intelligibility at a minimum wattage across a frequency range of 300 to 8000 HZ and shall be white in color. Speakers shall be ADA, NFPA and ANSI compliant.
- 2.10.1 Speakers for typical classrooms shall be tapped at ¼ watt with exterior speakers tapped at 2 watts. Other areas such as Theaters, Auditoriums, Gymnasiums, Team Rooms, Cafeterias, Kitchens and all shop areas shall be tapped at ½ watt.
- 2.10.2 Contractor shall also include (2) additional site visits within the first year to adjust speaker output on a space by space basis as requested by the owner.
- 2.11 STROBES. The strobe unit shall have a meantime between failure (MTBF) of 1,000 hours or greater. The strobe section shall have a minimum flash rate of approximately one flash per second, with candela rating as per UL standard 1971. Housing shall be white.
- 2.11.1 In areas containing two or more audible devices, or three or more visual devices, these devices shall be synchronized, per NFPA 72, Chapter 18 California Amendments (2016).
- 2.11.2 Maximum pulse duration to be 0.20 of a second with an ADAAG 4.28.3(3). Visual alarms maximum duty cycle of 40%.
- 2.11.3 Capable of providing minimum candela. Intensity as shown on plans (effective strength measured at the source).
- 2.11.4 The flash rate to be a minimum of 1 Hz and a maximum of 2 Hz per NFPA 18.5.3.1.
- 2.12 HEAT DETECTOR DEVICES shall be analog addressable, fixed temperature x rate of rise, fixed at 200°F and a 15°F/min rate of rise. In janitor rooms equipped with kilns, devices shall be fixed at 200°F.
- 2.13 SMOKE DETECTOR DEVICES shall be analog addressable, photo-electric.
- 2.14 CO – CARBON MONOXIDE detectors shall be provided in all Group E Classrooms and provided with a sounder base to alarm individual classrooms with a 4-pulse temporal pattern as well as transmitting a signal to the staffed remote annunciator.
- 2.15 DUCT TYPE DETECTORS shall be analog addressable, photo-electric type, provide with remote test switch and auxiliary contacts as required for control of A/C units or smoke dampers.

- 2.16 DIGITAL ALARM COMMUNICATOR TRANSMITTER. The control panel shall meet the requirements of UL 864 for central station connections, and shall be UL listed for use with the fire alarm control panel. The communicator shall be connected to supervise two telephone lines, all wiring required for this connection shall be provided by the fire alarm contractor Coordinate interface with District monitoring company as required.

PART 3 - EXECUTION

- 3.1 All wiring shall be (min) #18 AWG copper or as noted on drawings. All underground conductors shall be UL wet location rated for use in wet locations, West Penn "Aquaseal" or equal. There shall be no splices in underground handholes or vaults. A multi-conductor cable rated for use in wet locations will also be acceptable. It must be labeled "FIRE ALARM" in all pull boxes, using a water-tight labeling system.
- 3.2 Interior, dry location wiring for low voltage initiating circuits shall be #18 AWG copper, twisted shielded pair minimum, signaling circuits shall be No. 14 AWG minimum, and wiring for 120 volt circuits shall be No. 12 AWG minimum. All wiring shall be color coded, solid copper conductor. Use of power limited cable shall be restricted to controls listed for this purpose. Single conductors shall be type THHN/THWN-2 insulated copper.
- 3.3 Wire markers shall be provided for each wire connected to equipment. The marker shall be of the taped bank type, of permanent material, and shall be suitable and permanently stamped with the proper identification. The markers shall be attached in a manner that will not permit accidental detachment. Changing of wire colors within circuits shall be unacceptable.
- 3.4 A terminal cabinet shall be installed in the electric room for the fire alarm systems at each building. All fire alarm wiring shall terminate on UL approved strips in this terminal cabinet. All wiring shall be labeled at each termination strip. Wiring shall be configured such that all end-of-line resistors will be installed at the terminal cabinet.
- 3.5 Fire Sprinkler Activation detecting System(s) shall each be indicated on a separate zone in the fire alarm control panel.
- 3.6 Fire Alarm Control Panel and all other equipment shall be mounted with the center of all operable reset buttons, located a maximum of 48" front approach / 54" side approach above floor level.
- 3.7 Contractor shall provide complete wiring between all equipment.
- 3.8 The Fire Alarm/Life Safety Installation shall comply fully with all Local, State and National Codes, and the Local Authority Having Jurisdiction (AHJ) DSA.
- 3.9 The Fire Alarm Control Panel and power supply shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Panelboard as FIRE ALARM CIRCUIT.

- 3.10 The Control Panel Cabinet shall be grounded securely to a power system ground conductor. Provide a 1/2-inch conduit and 1#12 grounding conductor to the building electrical service ground bus.
- 3.11 Conduit shall enter into the Fire Alarm Control Panel back box only at those areas of the back box which have factory conduit knockouts.
- 3.12 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; an audible and visual trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
- 3.13 All cables and wiring shall be listed for Fire Alarm/Life Safety use, and shall be of the type as required by and installed per CEC Article 760.
- 3.14 Final System Acceptance
 - 3.14.1 Provide an NFPA Certificate of Compliance to DSA and the engineer of record. Complete fire alarm system shall comply with Chapter 14 of NFPA for testing and inspection and be sound-tested for audibility in all spaces requiring voice evacuation. This testing shall be performed in the presents of the project electrical engineer. Adjust speaker taps or provide additional speakers as required to provide correct audibility.
 - 3.14.2 The system will be accepted only after a satisfactory test of the entire system has been accomplished by a Factory-Trained Distributor in the presence of a representative of the authority having jurisdiction and the Owner's representative. This contractor shall provide all personnel, ladders and testing equipment to assist the local authority in completing this test. Actuate each device and verify that the system performs as specified.
 - 3.14.3 The Contractor will present a complete set of "as-built" Fire Alarm/Life Safety system drawings, and the factory supplied Operator's Manuals as required by the General Provisions section of this specification.
 - 3.14.4 Once the system has been tested and the certificate of compliance completed, the contract shall not be considered complete until after owner training has been completed. The contractor shall notify in writing their intent to provide the training for the system. This notification shall be given to the Division 21 Contractor, Architect and the Project Engineer a minimum of 2 weeks prior to the scheduled training session. The Division 21 Contractor and/or the architect shall be responsible for notifying the owner to confirm that the appropriate District personnel will be made available for this training session. If the Division 21 Contractor does not receive confirmation that the training session can be performed on the proposed date, then another time shall be provided. The training shall consist of the following:

- 3.14.4.1 Provide a minimum of one (1) four-to-six -hour training period located at the project site, to instruct District personnel in proper operation of all systems.
- 3.14.4.2 Provide a minimum of three (3) complete owner operation manuals for the District records.
- 3.14.4.3 Provide a minimum of two (2) complete as built sets of drawings for the District records.
- 3.14.4.4 Provide all spare parts as described in part 1 of these specifications
- 3.14.4.5 Provide written confirmation and proposed scheduled dates for follow up training and 1-year complete system test.

END OF SECTION

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**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 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- D. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- E. 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.
- F. Section 31 23 16 - Excavation: Site preparation for structure and paving.
- G. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

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.

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Site Clearing 31 10 00 - 1
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PART 2 PRODUCTS

- A. Fill Material: As specified in Section 31 23 23 - Fill

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 District and Architect before beginning removal process.

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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 District.

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 DSA, 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.

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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 Construction Manager 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 District.
- 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 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

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**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.
 - 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 for planting.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements.
- B. Section 01 45 33 - Code-Required Special Inspections.
- C. Section 01 70 00 - Execution and Closeout Requirements.
- D. Section 31 10 00 - Site Clearing.
- E. Section 31 23 16 - Excavation.
- F. Section 31 23 23 - Fill: Filling and compaction.
- G. Section 32 11 23 - Aggregate Base Courses
- H. Section 32 12 16 - Asphalt Paving.
- I. Section 32 13 13 - Site Concrete.

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 {\rs\#1} standards.
 - 1. Maintain one copy on site.

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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 Construction Manager, Architect and District and for directions to be followed for preservation, relocation or demolition of utilities.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Topsoil excavated on-site.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
- 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 DSA, Architect and District 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.

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- 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.
- B. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
 - 1. Coordinate topsoil with Section 10 00 - Site Clearing and Grubbing.
- C. Do not remove topsoil when wet.
- D. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- E. Do not remove wet subsoil , unless it is subsequently processed to obtain optimum moisture content.
- F. When excavating through roots, perform work by hand and cut roots with sharp axe.
- G. See Section 31 23 23 for filling procedures.
- H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- I. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.
- J. 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.
- K. 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.
- L. 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.

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M. 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. Top Surface Under Paving: Plus or minus 0.04 foot (1/2 inch) from required elevation.

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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. 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 District 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

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**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. Section 01 40 00 - Quality Requirements: Inspection of bearing surfaces.
- B. Section 01 50 00 - Temporary Facilities and Controls: Dewatering excavations and water control.
- C. Section 01 57 13 - Temporary Erosion and Sediment Control (SWPP): Slope protection and erosion control.
- 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; temporary bracing and shoring. General requirements for dewatering of excavations and water control.
- E. Section 02 41 00 - Demolition: Shoring and underpinning existing structures.
- F. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.
- G. Section 31 22 00 - Grading: Grading.
- H. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.
- I. Section 31 23 23 - Fill: Fill materials, backfilling, and compacting.

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/ft³ (2,700 kN-m/m³)).

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

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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 DIG ALERT NOTIFICATION

- A. Before any excavation in or near the public right-of-way, contact the Underground Service Alert of Southern California (Dig Alert) at 811 for information on buried utilities and pipelines.
- B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.
- C. Call at least Two (2) full working days prior to digging.
- D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of your excavation and if not, they will let you know there is no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).

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- E. The Law requires to hand expose to the point of no conflict 24 inches on either side of the underground facility, to know its exact location before using power equipment.
- F. If caught digging without a Dig Alert ticket fines can be as much as \$50,000 per California government code 4216.

3.02 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 District 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.

3.03 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 10 00 for clearing, grubbing, and removal of existing debris.
- C. See Section 31 22 00 for topsoil removal.
- D. Locate, identify, and protect utilities that remain and protect from damage.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- F. 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.
- G. See Sections 01 70 00 and 02 41 00 for underpinning and shoring of adjacent structures that could be damaged by excavating work.

3.04 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.

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- 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 District or District'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.

3.05 EXCAVATING

- A. Excavate to accommodate new structures, paving/site structures, construction operations, 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. Completely remove all undocumented fill materials at the site.
 - b. In addition, remove weathered portions of the Mission Valley and/or Stadium Conglomerate, if encountered beneath settlement-sensitive improvements and foundations
 - c. Anticipate removal depths between 4 to 6½ feet will be necessary within the proposed building pad areas.
 - d. Where the horizontal lateral limits of the removal excavations cannot be achieved due to existing site improvements, a 2:1 (horizontal to vertical) projection off the bottom of the footings from the existing settlement-sensitive improvements and maintain a 1:1 (horizontal to vertical) projection off existing utilities, hardscape, and site walls.
 - e. Remaining materials should be “benched” during grading.

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- f. The bottom of all removals are to be evaluated by a Certified Engineering Geologist from Leighton to confirm conditions are as anticipated.
 - g. Building Footprint:
 - 1) Within the footprint of proposed buildings, remove/over-excavate, fill and recompact, minimum 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 3 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.
 - h. Flatwork/Hardscape/Pavement
 - 1) In areas of proposed concrete flatwork or pavement, provide a minimum over-excavation and recompaction of 0.67 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.
 - i. 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.
 - j. 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.
 - k. 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.
9. 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.

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- 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.

3.06 SUBGRADE PREPARATION

- A. See Section 31 23 23 for subgrade preparation at general excavations.

3.07 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. See Section 31 23 23 for fill, backfill, and compaction requirements at general excavations.
- C. See Section 31 22 00 for rough and final grading and topsoil replacement requirements.

3.08 REPAIR

- A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23 at no additional cost.

3.09 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.

3.10 CLEANING

- A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.

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- 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 District to test soils prior to export for disposition.

3.11 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

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**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 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.

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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.

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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 DIG ALERT NOTIFICATION

- A. Before any excavation in or near the public right-of-way, contact the Underground Service Alert of Southern California (Dig Alert) at 811 for information on buried utilities and pipelines.
- B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.
- C. Call at least Two (2) full working days prior to digging.
- D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of your excavation and if not, they will let you know there is no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).
- E. The Law requires to hand expose to the point of no conflict 24 inches on either side of the underground facility, to know its exact location before using power equipment.
- F. If caught digging without a Dig Alert ticket fines can be as much as \$50,000 per California government code 4216.

3.02 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.03 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.

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3.04 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.

3.05 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.

3.06 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.

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- 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.

3.07 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.

3.08 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.

3.09 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.

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- D. Correct unauthorized excavation at no cost to District.
- 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 District.
- 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.

3.10 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.

3.11 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

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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 01 57 13 - Temporary Erosion and Sediment Control (SWPP): Slope protection and erosion control.
- C. Section 03 30 00 - Cast-in-Place Concrete.
- D. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.
- E. Section 31 22 00 - Grading: Site grading.
- F. 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/ft³ (2,700 kN-m/m³)).
- 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.

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- 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 District.
- 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.

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- 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: See Section 03 30 00; compressive strength of 2,500 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

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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.

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- 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.

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- 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 AWWA C508
 - 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. 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.
- E. 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.
- F. 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.

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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 District'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 District 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.

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- 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

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**SECTION 32 11 23
AGGREGATE BASE COURSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.
- C. Soil sterilization.

1.02 RELATED REQUIREMENTS

- A. Section 31 22 00 - Grading: Preparation of site for base course.
- B. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.
- C. Section 31 23 23 - Fill: Compacted fill under base course.
- D. Section 32 12 16 - Asphalt Paving: Finish and binder asphalt courses.
- E. Section 32 13 13 - Site Concrete: Finish concrete surface course.

1.03 REFERENCE STANDARDS

- A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- B. 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.

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- 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. South Coast Air Quality Management District (AQMD).
- C. Source Quality Control: Obtain materials from one source throughout.

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 District.
- 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. Aggregate Type Class II: Coarse or crushed aggregate, conforming to Municipality, ASTM F588 Section 200-2.2.
- B. Coarse Aggregate: Pit run washed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM D2487 Group Symbol GW.
- C. 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 District, 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.
 - b. Pro-Serve Inc.; Bare-Spot Monobor-Chlorate: www.pro-serveinc.com.

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- c. Casoron 50W by Uniroyal Chemical Co., Inc.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. 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.

PART 3 EXECUTION

3.01 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 District.
 - 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.

3.02 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.

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3. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Construction Manager 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.

3.03 INSTALLATION

- A. 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.
- B. 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.
- C. Under Bituminous Concrete Paving:
1. Compact to 95 percent of maximum dry density and 90 percent at pedestrian-only traffic.
 2. 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.

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- 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.
 - 3. 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.
 - 4. 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.
 - 5. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.
 - 6. 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.
 - 7. Remove excess material from the site to a legal disposal area.
- D. Under Portland Cement Concrete Paving:
 - 1. Compact to 95 percent of maximum dry density and 90 percent at pedestrian-only traffic.
- E. Place aggregate in maximum 4 inch layers and roller compact to specified density.
- F. Level and contour surfaces to elevations and gradients indicated.
- G. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- H. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- I. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- J. Apply herbicide to finished surface.

3.04 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.

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- 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.

3.05 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.

3.06 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

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**SECTION 32 12 16
ASPHALT PAVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single course bituminous concrete paving.
- B. Double course bituminous concrete paving.
- C. Surface sealer.
- D. This section compliments and shall be coordinated with Civil Drawing specifications / requirements. The most stringent requirements shall be utilized.
- E. Asphaltic concrete paving for vehicular traffic and curbs, including necessary patching and repair of damaged new and existing paving.
- F. 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.
- B. Section 31 22 00 - Grading: Preparation of site for paving and base.
- C. Section 31 23 23 - Fill: Compacted subgrade for paving.
- D. Section 32 11 23 - Aggregate Base Courses: Aggregate base course.
- E. Section 32 13 13 - Site Concrete: Concrete curbs.
- F. Section 32 17 13 - Concrete Wheel Stops: Concrete bumpers.
- G. Section 32 17 23 - Pavement Markings.

1.03 REFERENCE STANDARDS

- A. AI MS-19 - Basic Asphalt Emulsion Manual.
- B. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
- C. 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:

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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.

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- 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.

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- 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, SS1-h, per SSPWC (Greenbook) Section 203-9.
 - 2. Acceptable Manufacturers:
 - a. Blue Diamond Asphalt; Satin Seal: www.bluediamondasphalt.com.
 - b. Diversified Asphalt Product; Over Kote: www.diversifiedasphalt.com.
 - c. Gold Star Asphalt Products: goldstarsphalt.com
 - d. SealMaster Pavement Products & Equipment; MasterSeal: sealmaster.net.
 - e. Vulcan Materials Company; GuardTop: www.vulcanmaterials.com.
 - f. Western Colloid Products; Park Top: www.westerncolloid.com.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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.

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2.04 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.

2.05 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, 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. See Section 32 11 23 - Aggregate Base Courses for product information.
- 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.

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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 - Excavation or 31 23 23 - Fill, 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.

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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. See Section 32 11 23.
- 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.

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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.

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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 Architect, 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.

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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 "alligating" 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.

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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 District.
- 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

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**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. CONC-2, CONC-3

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 26 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- 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 - Americans with Disabilities Act (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. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.

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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 Sections 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 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 11B-403.5.1, not interrupted by steps or by abrupt changes in level.
 - a. CBC 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 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.

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- 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.
 - 2) L.M. Scofield Company (Sika Brand); Cureseal-W: www.scofield.com.
 - 3) W. R. Meadows Company; Intraguard: 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.

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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.

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- 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.

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- 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.

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- 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

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Site Concrete 32 13 13 - 7
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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 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (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 A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- F. 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.
- G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- H. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
- I. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
- J. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- K. CBC - California Building Code.
- L. CBC Ch. 11B - California Building Code-Chapter 11B.
- M. CLFMI CLF-FIG0111 - Field Inspection Guide.
- N. CLFMI CLF-PM0610 - Product Manual.
- O. CLFMI CLF-SFR0111 - Security Fencing Recommendations.
- P. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing.
- Q. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric).
- R. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

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1.03 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. Design Calculations: For high wind load areas, provide calculations for fence fabric and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.
- D. 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.
- E. Samples: Submit two samples of fence fabric, windscreen, 12 inch by 12 inch in size illustrating construction and colored finish.
- F. Manufacturer's Installation Instructions: Indicate installation requirements and templates.
- G. Manufacturer's Qualification Statement.
- H. Fence Installer Qualification Statement.
- I. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.
- J. Field Inspection Records: Provide installation inspection records that include post settings, framework, fabric, fittings and accessories, gates, and workmanship.

1.04 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.

1.05 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 rusting or breakdown of 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 on the Accessible Route: Meet all the requirements of an accessible door in compliance with CBC Ch. 11B-404 and 11B-206.5.
 - 2. Gate Clear Opening Width: 32 inches minimum. CBC Ch. 11B-404.2.3

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- a. Projections: None below 34 inches and 4 inches maximum projections into it between 34 inches and 80 inches above the finish floor or ground.
- 3. Gate Hardware: Meet the requirements of CBC Ch. 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 11B-404.2.7 and 11B-309.4.
- 4. 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 Ch. 11B-404.2.10
- 5. Maximum effort to operate a gate to not exceed 5 lbf. CBC Ch. 11B-404.2.9.
- 6. Bottom of Gate: Maximum 3 inches from finish surface of the path of travel.
- B. Exit Devices: Comply with State Fire Marshal Standard 12-10-3 Exits, Section 12-10-302.
 - 1. Cross-bar: Extend across not less than one-half the width of the door/gate.
 - 2. Ends of Cross-Bar: Curve, guard or otherwise designed to prevent catching on the clothing of persons during egress.

2.02 MANUFACTURERS

- A. Chain Link Fences and Gates:
 - 1. Ameristar Perimeter Security, USA : www.ameristarfence.com/#sle
 - 2. Master-Halco, Inc: www.masterhalco.com/#sle.
 - 3. Merchants Metals: www.merchantsmetals.com/#sle.
 - 4. 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: 2.38 inch diameter.
- C. Line Posts: 4 inch diameter, HSS 4 x 0.313.
- D. Corner and Terminal Posts: 2.38 inch diameter.

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- E. Gate Posts: 3-1/2 inch diameter.
- F. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
- G. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.
- H. Gate Frame: 1.66 inch diameter for welded fabrication.
- I. 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.
- J. Tension Wire: 6 gauge, 0.1920 inch thick steel, single strand.
- K. Tension Band: 0.105 inch thick steel.
- L. Tension Strap: 3/16 by 3/4 inch thick steel.
- M. Tie Wire: Aluminum alloy steel wire.

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.
 - a. For oversize steel tube and plate components, see ASTM A500/A500M, Gr B in Section 05 50 00 - Metal Fabrications.
 - 2. Line Posts: Type I round in accordance with FS RR-F-191/1D.
 - 3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
 - 4. 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. Gates:
 - 1. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Ch. 11B-404.
 - 2. Sizes: As indicated on the Drawings, minimum width not be less than 36 inches (clear opening width to be not less than 32 inches).
 - 3. Fabrication:
 - a. Frames: Continuously welded miter cut joint corners.
 - 1) Grind welds flush and smoth.
 - 2) Hot dip galvanized after fabrication.

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- 3) Field welds: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- b. Fabric: Install fence fabric to side member with full height tension bars and bands, spaced at maximum 14 inches on center.
 - 1) Attach to horizontal members with wire ties at maximum 12 inches on center.
- c. Latches: Weld latches and strikes to posts and frames.
 - 1) Hot dip galvanized after fabrication.
- d. Hinges: Burr or center punch threads of gate hinge bolts to avoid removal of nuts.
- e. Clearances:
 - 1) Bottom: 1-1/2 inches.
 - 2) Top: 1 inch.
- f. Gates in Sloping Areas: Conform to grade.
- g. Provide an opening in each gate for access to locking device or padlock. Knuckle fabric ends surrounding the opening.
- h. Sliding and Swing Barricade Gates:
 - 1) Wheel Housing: Provide unit to fit tightly to roll track and prevent gate from rolling over objects.
 - 2) Unsupported cantilever roll gates are not acceptable.
 - 3) Provide both top and track gate stops as indicated on Drawings.
- 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; keeper to hold gate in fully open position.
- 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. Provide 3 hinges for gates over 16 feet wide.
- D. Hinges: Finished to match fence components.
 - 1. 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.
 - 3. Provided by District.
 - 4. Mounting: Center.
- E. Latches: Finished to match fence components.
 - 1. Fork type latch capable of retaining gate in closed position, except gates with panic hardware.
 - 2. Provided by District.

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- F. Locking: Provide padlock capability on non-pedestrian gates only. Do not install padlock capability on Exit Gates, gates on Path of Travel with Exit Devices and other pedestrian gates.

2.06 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.

2.07 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.
- B. Components and Fabric: Vinyl coated over coating of 1.8 ounces per square foot galvanizing.
- C. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
- D. Accessories: Same finish as framing.
- E. 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 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
 - 1. Space line posts at intervals not exceeding 10 feet.
- B. Place fabric on outside of posts and rails.
- C. Set intermediate, terminal, and gate 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. 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.
- G. Install center brace rail between posts with fittings and accessories for fence height 8 feet and higher, inclusive.
- H. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- I. Install center and bottom brace rail on gate leaves, welded construction.
- J. Do not stretch fabric until concrete foundation has cured 28 days.
- K. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- L. Position bottom of fabric 2 inches above finished grade.
- M. Fasten fabric to top rail, line posts, braces, and bottom tension wire with one complete wrap tie wire at maximum 15 inches on centers.
- N. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

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- O. Install bottom tension wire stretched taut between terminal posts.
- 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. Provide a transom rail and fabric at top of pedestrian gate openings.
 - 1. Provide transom rail at minimum 80 inches above high point of grade at gate opening.
 - 2. Pin or or rivet transom rail to rail end fittings with 1/4 inch mild steel rivets through rail and peen. Welding on rail ends is not permitted.
- S. Provide concrete center drop to footing depth and drop rod retainers for the inactive leaf at center of double gate openings.
 - 1. Exceptions: Gates with panic devices.
- T. Peen all bolts upon installation.

3.03 FENCE ADJUSTMENTS

- A. Where finish grade is is raised 6 inches or less, cut and re-knuckle existing fence fabric. Adjust tension wire and and tie to fabric. Bottom of fabric to be 3/4 inch above grade.
- B. where finish pavement is lowered 6 inches or less, remove post footing to flush with finish grade; adjust fabric and attachments. Bottom of fabric to be 3/4 inch above grade.
- C. Entirely replace post footings and fabrics that require adjustment after 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.
 - 1. Install fence fabric free from barbs or other projections. installed fence fabric with such defects will be considered defective.

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3.06 CLEANING

- A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- B. Clean fence with mild household detergent and clean water rinse well.

END OF SECTION

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SECTION 32 84 00
IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section covers the furnishings of all materials and performing all operations to provide a complete operable Landscape Irrigation System as directed on the drawings including the following:
 - 1. Trenching, stockpiling excavated material and refilling trenches.
 - 2. Irrigation System components including but not limited to: piping, valves, fittings, heads, wiring and final adjustments as determined by the District Representative to insure efficient and uniform distribution.
 - 3. Testing and inspection of Irrigation System.
 - 4. Clean up and maintenance.
- B. Related Sections include the following:
 - 1. Division 31 Section 23.16.13 "Trenching".
 - 2. Division 32 Section 93 00 "Planting".
 - 3. Division 32 Section 13.13 "Site Concrete".

1.02 DEFINITIONS

- A. Lateral Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Pressure Piping: Downstream from point of connection to water distribution piping to and including control valves. Piping is under water distribution system pressure.
- C. The following are industry abbreviations for plastic materials.
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic
 - 2. NP: Nylon plastic
 - 3. PE: Polyethylene plastic
 - 4. PP: Polypropylene plastic
 - 5. PTEF: Polytetrafluoroethylene plastic
 - 6. PVC: Polyvinyl chloride plastic

1.03 GENERAL REQUIREMENTS

- A. Code Requirements shall be those of State and Municipal Codes and Regulations locally governing this work, providing that any requirements of the Drawings and Specifications, not conflicting therewith but exceeding the Code Requirements shall govern, unless written permission to the contrary is granted by the Architect.
- B. Conform to the requirements of the reference information listed below except where more stringent requirements are shown or specified in the most current set of construction documents:

1. American Society for Testing Material (ASTM), for test methods specifically referenced in this section.
 2. Underwriter's Laboratories (UL), for UL wires and cables.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 4. Comply with ASTM F645, "Guide for Selection, Design, and Installation of Thermoplastic Water- Pressure Piping Systems."
 5. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.
 6. Furnish plastic pipe and fittings permanently marked with size, class, and type of pipe, working pressure at 73.4 degrees F, and National Sanitation Foundation (NSF) rating.
- C. A licensed and bonded plumbing contractor shall execute work involving substantial plumbing for installation of copper piping, backflow prevention devices and other related work. Obtain any necessary permits prior to beginning work.
- D. Specified depths of pressure supply lines, laterals and pitch of pipes as stated in this section are minimums. Settlement of trenches lower than grades specified on the final grading plans is cause for removal of finish grade treatment, refilling trenches, re-compacting and repairing of finish grade treatment.
- E. Follow current printed manufacturer's specifications and drawings for items or information not specified or graphically indicated in the most current set of construction drawings.
- F. Dimensions indicated are approximate. It is not possible to indicate all required offsets, fittings and other related equipment graphically on the construction drawings. Contractor shall be responsible for minor changes caused by actual site conditions. Before proceeding with any work, Contractor shall carefully check and verify all dimensions of related architectural elements, utilities and landscaping; and furnish and install required fittings.
- G. Do not install the irrigation system as shown on the Drawings when it is obvious that actual field conditions such as physical obstructions, grading discrepancies and field dimensions vary from those recorded on the construction drawings. Immediately bring any such discrepancies to the attention of the District Representative prior to proceeding with work. If immediate notification is not given and such discrepancies exist, Contractor shall assume full responsibility for necessary revisions, as determined by the District Representative.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Exercise caution in handling, loading and storing of plastic pipe and fittings to avoid damage.
- B. Transport pipe in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subjected to undue bending or concentrated external load at any point. Support pipe during storage from sagging and bending. Store plastic piping protected from direct sunlight.
- C. Discard pipe that has been dented or damaged unless such dent or damaged section is cut and rejoined with a coupling.

- D. Protect valves, fittings, and specialties from moisture, dirt, and other possible contaminants.

1.05 SEQUENCING AND SCHEDULING

- A. Install landscape headers, sidewalks, and mowing strips before installation of sprinkler system. Sleeves and mainlines under paving shall be in place before paving construction.
- B. Specimen trees (24 inches box and larger) shall be installed before the location of the irrigation system.
- C. Coordinate sprinkler piping with utility work.
- D. Obtain permission, in writing, from the District at least 2 working days before shutting off existing in-use water lines. Contractor shall receive instructions from the District as to the exact length of time of each shut-off. Notify the District Landscape Inspector of said intent.

1.06 EXISTING FIELD CONDITIONS

- A. Preserve and protect all existing trees, hardscape and architectural elements from damage due to work in this section. In the event that damage does occur to inanimate object and structures, Contractor shall repair or replace such damage to the satisfaction of the District Representative. Contractor at Contractor's expense shall replace damaged or injured living plant material.
- B. Trenches adjacent to or under existing trees shall be closed within 24 hours. When this is not possible, the side of trench closest to the tree or trees affected shall be covered with moistened burlap.
- C. Protect, maintain and coordinate work with other contracts, specifications, trades, and utilities. Exercise extreme care in excavating and working in areas where utilities exist. Contractor shall be responsible for damages caused by its operations. In the event that damage does occur, Contractor shall pay the costs of such repairs.
- D. Use caution where trenches and piping cross existing roadways, sidewalks, hardscape, paths or curbs. Contractor shall be responsible for damages caused by its operations.

1.07 REQUIRED DOCUMENTS

- A. Service Manuals
 - 1. Submit, prior to beginning construction, a list of irrigation equipment to be used, accompanied by manufacturer's catalog data, specifications, or other literature clearly indicating compliance with specification requirements for each item.
 - 2. Furnish (4) four service manuals to the District prior to scheduling a walk through for Substantial Completion. Submit manuals in bound form complete with a table of contents, copy of contractor's warranty, and workmanship form on company letterhead. Manuals shall contain complete large-scale drawings of all installed equipment showing component warranties and catalog numbers together with the manufacturer's name and address. Manuals shall include operation instructions. Manuals shall be subject to approval by the District or District Representative as to completeness.

B. Record Drawings

1. Prior to beginning work in the field, secure a complete set of irrigation plans, details, and specifications on reproducible drawings at the original scale. Contractor shall be responsible for making a set of black line prints for every week on the project. At the end of each working day, Contractor shall record all work accomplished for that day on the set of black line prints in red ink. These record drawings shall be brought up to date at the end of each workweek by a qualified draftsman. The drawings should indicate the following:
 - a. Any zoning changes.
 - b. Dimension from two permanent points of reference (building corners, fixed hardscape corners, road intersections, permanent existing utilities) the location of the following items:
 - 1) Connection to existing water lines
 - 2) Routing of pressure supply lines at every 100 feet along routing.
 - 3) Isolation ball valves
 - 4) Quick coupling devices
 - 5) Electric control valves
 - 6) Check valves
 - 7) Control wire routing (if routed separately from pressure supply line)
 - 8) Other equipment as directed by the District.
3. Prior to scheduling a walk through for Substantial Completion, provide a record set of field drawings as described above to the District for review. After review, the District will return the set to the field foreman requesting further information or will notify that the record set of field drawings are complete. After approval from the owner, a walk through for Substantial Completion may be scheduled.
4. Prior to scheduling the final walk through, the final set of irrigation record drawings shall be professionally drafted.
5. Contractor is responsible for delivering the final set of record drawings to the District or District Representative prior to initiating the maintenance period.

C. Controller Charts

1. Provide drawings for each controller unit installed on the project. The controller drawings shall be an actual blueprint reduction of the new area covered by that controller unit and shall be at the maximum allowable scale that will fit inside the controller door without folding the drawing. The chart shall be a plot plan, entire or partial, showing building(s), walks, roads and walls. Drawings shall show valves and sprinkler heads serviced by that particular controller identifying each station by separate color. Number valves shall match the operation schedule and the drawings. All zones controlled by a controller shall be included on a single sheet. Only those areas controlled by that controller shall be shown. District's Landscape Inspector shall review this print prior to submittal. It shall be hermetically sealed by plastic, and then be secured to the inside door of the controller enclosure.

2. Prepare and submit additional copies of color coded controller drawings as follows: two –11 inches x 17 inches laminated copies, one - 8 inches x 11 inches laminated copy, and one - 11 inches x 17 inches non-laminated copy.
3. Submit controller charts to the District representative prior to requesting a walk-thru for substantial completion.

1.08 WARRANTY

- A. Contractor shall warrant materials against defects and guarantee workmanship for the period of one year. Contractor shall be responsible for coordinating warranty items with manufacturer /distributor and the District.
- B. Settlement of trenches, which may occur during the one-year warranty period, shall be repaired by Contractor at no expense to the District.

1.09 EXTRA STOCK AND EQUIPMENT CERTIFICATIONS

- A. Prior to a release of responsibility, schedule a walk through with the District Representative and disclose and provide the following:
 1. Two (2) rotor heads with nozzles and screens of each type used, for every 100 rotor heads installed on the project.
 2. Five (5) Rainbird RWS devices for each type used, for every 100 devices installed on the project.
 3. One (1) Quick Coupler key with 90 degree swivel and hose bib attachment, for type and size of quick coupling valve used on project.
 4. Two (2) sets of the required equipment specific specialty tools for removing, disassembling and adjusting each type of sprinkler head, isolation valve, and electric control valve used on the project.
 5. All manufacturers' rebate certificates.
 6. One (1) nickel-chrome plated 16-gauge steel 36 inches tube sampler soil probe, as manufactured by Oakfield or approved equal.
 7. All manufacturers' warranty information stating length of warranty and how to exercise warranty on all valves, irrigation controllers and sprinkler heads.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The design of the irrigation system is based on the manufacturers and products specified herein or indicated on the Drawings. Substitutions will be permitted only with the Architect or District Landscape Inspector's approval. Where such substitution will change the coverage or flow rates of the sprinkler heads, the request for substitution shall include layout plans showing revised sprinkler head locations. Such revised layout plans shall provide coverages and watering rates equivalent to those indicated. The District's Landscape Inspector shall be notified of any design changes or substitutions.

2.02 PIPING – SCHEDULE 1

- A. General Piping:
 - 1. Pipe sizes shown are nominal inside diameter unless otherwise noted.
 - 2. Pipe shall be identified with the following indelible markings:
 - a. Manufacturer's name
 - b. Nominal pipe size
 - c. Schedule or class
 - d. Pressure rating
 - e. NSF (National Sanitation Foundation) seal of approval
 - f. Date of extrusion

2.03 SOLVENT WELD PRESSURE SUPPLY LINE – PROJECT DATA SHEET 1

- A. Solvent Weld Pressure Supply Line: (downstream of Backflow prevention device) shall be PVC schedule 40 conforming to ASTM D1785-12 for pipe sizes 3/4" through 1 1/2", and PVC Class 315 BE (SDR 13.5) conforming to ASTM D2241 for pipe sizes 2" and larger.
 - 1. Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B.
 - 2. Type 1, Grade 1.
- B. Fittings: Standard weight, Schedule 80, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
 - 1. Threads- Injection molded type (where required)
 - 2. Tees and Ells- side gated
 - 3. Expansive couplings are not allowed by the District.
- C. Threaded Nipples: ASTM D2464, Schedule 80 with molded threads
- D. Joint Cement and Primer: Type as recommended by manufacturer of pipe and fittings

2.04 NON-PRESSURE LATERAL LINES – PROJECT DATA SHEET 2

- A. Non-Pressure Lateral Lines: (downstream of electric remote control valve) PVC Schedule 40, conforming to ASTM D1785-12.
- B. Fittings: Standard weight, Schedule 40, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
 - 1. Threads- Injection molded type (where required)
 - 2. Tees and Ells-side gated
 - 3. Threaded Nipples: ASTM D2464, Schedule 80 with molded threads.
- C. Joint Cement and Primer: Type as recommended by manufacturer of pipe and fittings

2.05 SLEEVING AND CONDUIT – PRODUCT DATA SHEET 3

- A. All sleeving for pressure supply line and non-pressure supply lines shall be twice the nominal size of the pipe within, minimum.
- B. Sleeving and Conduit Material:
 - 1. PVC SCH 40 for 1" to 2-1/2" pressure supply line.

2. PVC SCH 40 for non-pressure lines.
3. (1) one 3/4" PVC SCH 40 conduit for up to 5 wires.
4. (1) one 1-1/2" PVC SCH 40 conduit for up to 8 wires.

2.06 COPPER PIPE AND FITTINGS – PRODUCT DATA SHEET 4

- A. Pressure supply line or Non-Pressure lateral line in structure (per mechanical, structural or mechanical engineers plans): Type K Copper hard tempered, in accordance with ASTM B42-10.
- B. Fittings: Wrought copper, solder joint type.
- C. Joints: Solder shall be made up of 45% silver, 15% copper, 16% zinc and 24% cadmium and solids at 1125° F and liquids at 1145° F.

2.07 BRASS PIPE AND FITTINGS – PRODUCT DATA SHEET 5

- A. Pressure Supply line (from point of connection through Backflow Prevention Device) Brass pipe shall be regular weight, 85% red brass, ANSI Schedule 40 screwed pipe.
- B. Fittings: Medium brass, screwed at 125 pound class.

2.08 ISOLATION VALVES – SCHEDULE 4

- A. Isolation Gate Valve – PRODUCT DATA SHEET 1: Bronze, screw-in-bonnet, non-rising stem, cross handle, solid wedge, threaded valve as manufactured by Nibco, or approved equal.
- B. All isolation valves shall be set in a valve box in accordance with Section 3.15 and SCHEDULE 11 – VALVE BOXES. Mark all isolation valves with "GV" on lid.

2.09 QUICK COUPLING VALVES – SCHEDULE 5

- A. Quick Coupler Assembly – PRODUCT DATA SHEET 1: Two-piece unit consisting of a coupler water seal valve assembly and a removable quick connecting coupler key designed to allow spring and key track to be serviced without shutdown of main. A positive, watertight connection shall be made between coupler key and valve.
 1. Coupler Valve: Double lugged type, 1 inch size, designed to withstand a working pressure of 150 psi. Bodies of valves shall be red brass. Provide valves with lockable hinged covers with springs for positive closure on key removal. Covers shall be red brass with a permanently bonded rubber-like vinyl cover, yellow in color. Manufactured by Rain Bird Manufacturing Corporation, model 44-LRC.
 2. Quick Coupler Key: Brass or bronze with a hose bib assembly.

2.10 ELECTRIC CONTROL VALVES – SCHEDULE 6

- A. Remote Control Valves – PRODUCT DATA SHEET 1: Valve shall be as manufactured by Rainbird Manufacturing Corporation, brass, -no substitutions. Control Valves shall be set in a valve box per Section 3.15 and SCHEDULE 11 – VALVE BOXES in this specification. Mark all control valve boxes with station number.
- B. Valve identification tags – PRODUCT DATA SHEET 2: Shall be pre-printed, double sided standard yellow tags as manufactured by Christy's or approved equal.

2.11 CHECK VALVES – SCHEDULE 7

- A. Swing Check Valves – PRODUCT DATA SHEET 1: Brass or bronze 100 pound class for non-pressurized lines.
- B. Spring Check Valves – PRODUCT DATA SHEET 2: King Brothers KC-XXX-S, PVC, Thread x Thread, stainless steel internal parts and adjustable spring tension from 4 to 15 psi, to prevent low sprinkler head drainage.

2.12 VALVE BOXES – SCHEDULE 8 – PRODUCT DATA SHEET 1

- A. Valve Boxes: Boxes adjacent to paved areas subject to vehicular traffic shall be precast concrete with cast iron lids designed to resist vehicular traffic. Concrete valve boxes shall have lockable covers. Boxes in all other areas shall be plastic valve boxes as follows:
- B. Quick Couplers, Spare Wire Boxes and Pull Boxes: Round 10” diameter valve box, green in color, with stainless steel hex bolt, including washer, size and type to secure lid. Carson L Series 910 with “T” cover manufactured by Oldcastle Precast, Inc. or approved equal.
- C. Electric Control Valves, Gate Valves, Ball Valves, Flow sensors, and Master Valves: Rectangular 12” valve box, green in color, with stainless steel hex bolt, including washer, size and type to secure lid. As manufactured by Carson-Brooks Series 1419-12-2B hinged cover or approved equal.

2.13 CONTROL WIRE – SCHEDULE 10

- A. All wire for control valves shall be insulated with solid copper conductor of type approved for direct burial. Use color-coded wire for pilot wires, a different color for all valves, and install per valve manufacturer’s specifications and wire chart. Common wire for each controller shall be white with stripe of same color as pilot wires. Extra wires shall be black.

2.14 SPRINKLER HEADS – SCHEDULE 11

- A. Pop-up Rotary Type: Rotary sprinkler of the gear driven type shall be Hunter I-20’s. Nozzles shall be available for true matched precipitation rates.
 - 1. The sprinkler shall be available in adjustable arc or in full or part circle configuration. The adjustable arc sprinkler shall be adjustable from 40 degrees to 360 degrees in one-degree increments. Adjustments shall be made from the top of the riser assembly in either the up or down position. The part circle unit shall be a fixed arc type available in 90 degree and 180 degree arcs. The sprinkler shall have a purple cap.
 - 2. The pop-up sprinkler shall pop-up a minimum of 4 inches with nozzle discharge point 3-3/4 inches above grade. Nozzle shall be integrally molded multiple orifice type that can be changed with tools included. Radius shall be adjustable by means of a plastic, allen diffuser pin. Nozzle turret shall be molded with a service indentation to accept a tool for raising nozzle piston for service. The sprinkler shall have a purple cap.
 - 3. The sprinkler shall have either a 3/4 inch or 1 inch NPT inlet and shall be accessible by a threaded cap for easy service.
 - 4. The body of the sprinkler shall be constructed of non-corrosive heavy duty ABS. The sprinkler shall be equipped with a filter screen for debris stoppage.

5. All sprinkler heads with similar functions shall be of common manufacture and, shall be marked with the manufacturer's name and identification in a position where they may be identified without being removed from the system.

2.15 BUBBLER HEADS – SCHEDULE 12 – PRODUCT DATA SHEET 1

- A. Pre-manufactured Tree and shrub Bubblers: Use Rainbird RWS bubbler system with bubbler, swing joint, tube and cap. Bubbler system shall include sand sock covering.

2.16 THRUST BLOCKS – SCHEDULE 13 – PRODUCT DATA SHEET 1

- A. Thrust Blocks: Concrete thrust and anchor blocks shall be placed at each fitting 2" or greater, or where indicated on drawings, and shall consist of Class C @ 2000 psi with 4" slump Portland cement concrete.

2.17 SAND BEDDING – SCHEDULE 14 – PRODUCT DATA SHEET 1

- A. Sand bedding on all piping shall be clean construction grade type.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine field conditions prior to beginning the work of this section. Grading operations shall be completed and approved prior to beginning work.
- B. Verify all sleeve locations prior to beginning work in this section. Flag all existing sleeves and conduits installed by other trades. Report any conflicts and discrepancies to the District Representative immediately.
- C. Verify location of existing underground utilities, valves, manholes, catch basins, and other appurtenances that will affect the layout of the sprinkler system. Verify location of existing trees, new specimen trees, and other obstructions that will affect the layout of the sprinkler system. Verify location of stub outs and points of connection to the water supply system.

3.02 PREPARATION

- A. Locations of piping and equipment indicated on plans are diagrammatic and approximate and shall be adjusted as necessary and as directed to meet existing conditions and obtain complete water coverage. Contractor is responsible for irrigation system operation and complete coverage of the system. Contractor shall report any conflicts and discrepancies to the Architect and District Landscape Inspector immediately.
- B. Sprinkler lines shall have a minimum clearance of 6 inches from each other and from other utility lines. Do not install parallel lines directly over one another.
- C. Construct irrigation system to the sizes and grades at the locations indicated. Mark with powdered lime or marking paint routing of pressure supply line and stake the location of each bubbler head, electric control valve and other related equipment for the first three zones. District Representative shall review staking and direct any necessary changes with Contractor prior to proceeding to other zones. This review does not in any way alleviate

Contractor from the responsibilities associated with proper uniformity and distribution of head placement after staking.

- D. Install sleeves to accommodate pipes and wires under paving, hardscape areas, sidewalks, and paths prior to asphalt and concrete operations. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with ASTM D1557. Where not yet utilized, close sleeve ends with cloth duct tape.

3.03 EXCAVATION AND BACKFILLING OF TRENCHES

- A. Follow layout indicated on drawings as closely as possible in excavating trenches. Trenches shall be straight in alignment and support pipe continuously on bottom of trench. Remove rocks and debris greater than 1" in diameter. Over excavate as required for bedding material.
- B. Depth of Trench (in landscape areas):
 - 1. Pressure Supply Line: 18" from top of pipe to finish grade.
 - 2. Non-Pressure Line (for all rotor sprinkler heads and 12" popup heads): 18" from top of pipe to finish grade.
 - 3. Non-Pressure Line (for all non-rotor sprinkler heads and 6" popup heads): 12" from top of pipe to finish grade.
 - 4. Control Wiring: directly at side and bottom of pressure supply line.
 - 5. Pressure Supply line Locator Tape: above pipe, 6" below finish grade, (at a maximum depth of 12").
- C. Depth of Trench (under asphalt paving or concrete, pipe and wires to be in sleeving):
 - 1. Pressure Supply Line: 36" from top of finish grade to top of sleeve.
 - 2. Non-Pressure Line: 24" from top of finish grade to top of sleeve.
 - 3. Control Wiring: Directly at side and bottom of pressure supply line.
 - 4. Pressure Supply Line Locator Tape: Above pipe, 6" below finish grade, at a maximum depth of 12".
 - 5. Piping located under asphalt paving or concrete shall be installed with the appropriate sized sleeve. Backfilled with sand bedding (6" below pipe and 6" above pipe).
- D. Width of Trench:
 - 1. Pipe greater than 3": 14" minimum.
 - 2. Pipe less than 3": 7" minimum.
- E. Width Between Trenches:
 - 1. Irrigation trench to irrigation trench: 6" minimum.
 - 2. Irrigation trench to other trade trenches: 12" minimum.
- F. Sleeves: Provide appropriate sized sleeves for piping located under asphalt paving or concrete.
- G. Boring: Boring is only permitted where pipe must pass under an obstruction that cannot be avoided or removed. Backfill shall match surrounding soil density and grain. Boring under existing paving, sidewalks, or hardscape shall be permitted at Contractor's risk. Contractor shall repair all damage to such items at its own expense.
- H. Backfilling: Backfilling of trenches shall not be done until all required testing for the irrigation system has been completed.

1. Material: Excavated material is generally considered to be adequate for backfilling operations. Before beginning the backfilling operation, insure that backfill material is free from debris and rocks greater than 3/4" in diameter, and is not mixed with topsoil. These materials after separated from backfill, shall be legally disposed of at Contractor's expense.
2. Bed pressure supply line with construction grade sand 6" above and 6" below pipe. Remaining backfill shall be as described above.
3. Bed all electrical control wire, trenched separate from pressure supply line, with construction grade sand 6" above and 6" below wires.
4. Bed all sleeves with sand bedding with construction grade sand 6" above and 6" below pipe sleeves.
5. Set in place, cap and pressure test piping in the presence of the District Representative prior to backfilling.
6. Compact backfill to a 90% maximum density in accordance with ASTM D1557 with a mechanical tamper. Do not leave trenches open for a period greater than 48 hours. Open trenches shall be protected in accordance with current OSHA regulations. Slightly mound filled trenches for settlement after backfilling is compacted.
7. Smooth trenches to match surrounding finish grade prior to requesting walk through for Substantial Completion.

3.04 POINT(S) OF CONNECTION

- A. Point of connection shall be approximately as indicated on drawings. Connect new underground piping and valves, and provide all flanges, adapters, or other necessary fittings.

3.05 INSTALLATION OF SOLVENT WELD POLYVINYL CHLORIDE PIPE (PVC)

- A. Polyvinyl chloride pipe shall be cut with an approved PVC pipe cutter designed only for that purpose.
- B. All plastic-to-plastic solvent weld joints shall use solvent recommended by the pipe manufacturer. Do not install solvent weld pipe when temperature is below 40° F.
- C. Pipe ends and fittings shall be wiped with MEK, or approved equal, before welding solvent is applied. Welded joints shall be given a minimum of 15 minutes to set before moving or handling.
- D. Snake pipe from side-to-side on trench bottom to allow for expansion and contraction.
- E. All changes of direction over 15 degrees shall be made with appropriate fittings.
- F. When pipe laying is not completed by the end of the workday, close pipe ends with tight plug or cap.
- G. Install pressure supply line locating tape along the entire length of pressure supply line.
- H. Coordinate pressure supply line with sand bedding operations.
- I. No water shall be permitted in the pipe until inspections have been completed and a period of at least 24 hours has elapsed for solvent weld setting and curing.
- J. Center load pipe with small amount of backfill to prevent arching and slipping under pressure. Leave joints exposed for inspection during testing.

- K. Construct thrust blocks behind each fitting according to the following schedule (For 2" and larger pipe): Thrust developed per 100 psi pressure (lbs. force) for various fitting configurations:

Pipe Size:	90° Elbow:	45° Elbow:	Valves, Tees, Dead Ends:
1 1/2"	300	200	200
2"	500	300	400
3"	1,000	600	800

Approximate bearing strength of typical soils:

Soil Type	Lbs/sqft
Mulch, Peat, Etc.	0
Soft Clay	500
Sand	1,000
Sand and Gravel	1,500
Sand and Gravel with Clay	2,000
Sand and Gravel Cemented with Clay	4,000
Hard Pan	5,000

Divide the soil bearing strength by the thrust developed for each specific fitting size to determine the minimum size (ft/2) of each thrust block face. Excavate a minimum of 6" into virgin soil when forming thrust block. Don't over excavate. No thrust block shall be smaller than 1 cubic foot.

3.06 INSTALLATION OF COPPER PIPE

- A. Copper piping shall be cut by a power hacksaw, a circular cutting machine using an abrasive wheel, or by means of a hand hacksaw. No piping shall be cut with a metallic wheel cutter of any description. All pipes shall be reamed and rough edges or burrs removed so that a smooth and unobstructed flow is obtained.
- B. Eccentric reducing fittings shall be used where change in pipe size occurs. Bushings shall not be used unless specifically authorized by the District Representative.
- C. Apply emery cloth to pipe ends and wipe with clean cloth prior to solder welding pipe end to fitting. Apply an even layer of flux along area to be soldered. Apply solder uniformly around joint and let cool. After cooling lightly apply emery cloth along soldered area until smooth.
- D. All exposed piping under structural slabs shall be stenciled with "Irrigation Main" or "Irrigation Lateral" as required, at ten foot (10') intervals in black permanent ink lettering, 3/4" minimum high.

3.07 INSTALLATION OF BRASS PIPE

- A. Brass piping shall be cut by a power hacksaw, a circular cutting machine using an abrasive wheel, or by means of a hand hacksaw. All pipes shall be reamed and rough edges or burrs removed so that a smooth and unobstructed flow is obtained.

- B. Eccentric reducing fittings shall be used where change in pipe size occurs. Bushings shall not be used unless specifically authorized by the District Representative.
- C. Carefully and smoothly place joint compound on the male thread only. All screwed joints shall be tightened with tongs or wrenches. Caulking of any kind is not permitted.
- D. All exposed piping under structural slabs shall be stenciled with "Irrigation Main" or "Irrigation Lateral" as required, at ten foot (10') intervals in black permanent ink lettering, 3/4" minimum high.

3.08 INSTALLATION OF GATE VALVES

- A. Install gate valves in separate round valve boxes as specified on District Standard Detail drawings. All plastic valve boxes shall be secured with a stainless steel locking bolt mechanism, and set over 3/4" gravel with filter fabric.

3.09 INSTALLATION OF QUICK COUPLING VALVES

- A. Install quick coupling valves with brass riser set in concrete footing. Set plumb and true in center of box with QCV top 3" below box lid. Ensure that proper quick coupling key operation is provided with each installation.
- B. Install in separate round valve box secured with a stainless steel locking bolt mechanism. Set over 3/4" gravel with filter fabric.

3.10 INSTALLATION OF SPRINKLER HEADS

- A. Nozzle size of sprinkler heads shall be adjusted to suit any particular conditions of the area. This shall be done after the system has been thoroughly tested, immediately after written notification by the Architect.
- B. All sprinklers shall be installed on swing joints with outlets facing landscape areas. All swing joint threads shall be covered with teflon tape. All swing joint assemblies shall match inlet size of sprinkler head.

3.11 INSTALLATION OF CHECK VALVES

- A. Install check valves in a separate round valve boxes at a maximum of 10" below valve box cover. Plastic valve boxes shall be secured with a stainless steel locking bolt mechanism, and set over 3/4" gravel with filter fabric.

3.12 INSTALLATION OF VALVE BOXES

- A. Install valve boxes with each type of irrigation equipment so that top of valve box is above finish grade as specified on the District Standard Detail drawings. Valve box extensions are not acceptable except for mainline isolation gate valves.
- B. Place gravel sump below and around each valve box prior to installing valve box as specified on the detail drawings. Place remaining portion of gravel inside valve box, allowing full access in and around all fittings. Valve box shall be fully supported by gravel sump.
- C. Brand the valve box lid of associated equipment as follows:
 - 1. Electric control valve box lid with "Controller Letter and Station Number."

2. Quick coupling valve box lid with the letters "QC."
 3. Isolation gate valve box lid with the letters "GV."
 4. Spare Wire box lids with the letters "SW."
 5. Wire Splice box lid with the letters "WS."
 6. Check valve box lid with the letters "CV."
- D. Letter and number size of brands shall be no less than 1" and no greater than 1 1/2" in height and shall be 1/8" maximum in depth. Provide sample branding to the District or District Representative prior to commencement of work. Coordinate with District or District Representative any non-listed equipment box identification required.
 - E. Walk through for Substantial Completion shall not be allowed until all branding is complete and approved by the District Representative.

3.13 INSTALLATION OF BUBBLERS

- A. Flush circuit piping with full water pressure and install sprinklers after hydrostatic test is completed.
- B. Place RWS devised so that the device is perpendicular to finish grade. Devise cap shall be level and flush with finish grade of decomposed granite material.

3.14 QUALITY CONTROL

- A. Preconstruction Meeting: Contractor is responsible for contacting the Architect, and District Representative, prior to beginning construction and/or ordering materials, to establish a meeting to review and discuss project objectives, concerns and to review the construction documents to insure a complete understanding of required installation procedures.
- B. General Observation: The District's Inspector will visit the construction site at interim times during the construction process to access construction progress regarding installation of irrigation equipment to be in compliance with the drawings, details, specifications and site conditions. The District's Inspector will prepare a site report after each visit noting progress of installation, verbal communication with Contractor and identifying any field adjustments necessary which require modifications to the designed irrigation system. A copy of this site report will be delivered to both Contractor and the District's Construction Manager. Contractor shall immediately address each item on the site report before proceeding with further construction.
- C. Hydrostatic Pressure Testing the Pressure Supply Line: After backfilling, flushing, and prior to the installation of each electric control valve, drip valve assembly, isolation ball valve, quick coupling valve, and manual drain valve the irrigation system shall be pressure tested.
 1. Pressure testing shall be performed in the presence of the Architect and District or District Representative utilizing the following procedure:
 - a. Pressurize the irrigation system to 40 psi greater than the designated static pressure or 150 psi whichever is greater for a period of no less than 4 hours. The pressure gauge used for the pressure test shall not exceed readings greater than 300psi. Pressure pump and other equipment necessary for the test shall be furnished by Contractor.

- b. Test is acceptable if no leakage occurs within the system for the duration of the testing period.
 - c. If leaks occur, repair said leaks and begin pressure test again. Repeat this operation until no leaks occur in the irrigation system.
 - d. Before requesting a walk through for Substantial Completion, the entire irrigation system shall remain under pressure for a period of no less than 48 hours.
2. Inspection: In cases where inspection of the sprinkler system construction is required or where portions of the construction are specified to be performed under the direction or inspection of the District's Inspector, Contractor is required to notify the District's Inspector at least 3 working days in advance of the time such inspection or direction is required.
3. Inspection will be required for the following parts of the construction:
- a. Upon installation and testing of main lines; when pipes are laid and are to be submitted to pressure tests. Do not cover lines until they have been inspected and approved.
 - b. Upon installation and testing of valves, quick couplers, control valves, and wires.
 - c. When the sprinkler system is completed, perform a coverage test, in the presence of the District's Landscape Inspector, to determine if the system is complete. Furnish materials and perform construction required to correct inadequacies in the coverage.
 - d. Final inspection and performance test shall be at the same time as the final inspection of the landscape construction.
- D. Flushing: Center load all piping prior to flushing. After all new irrigation piping and risers are in place and connected and all necessary diversion work has been completed and prior to the installation of sprinkler heads, rotors and quick coupling valves, thoroughly flush piping system under full head of pressure. After the furthestmost riser from the point of connection begins to flush, continue flushing for duration of five minutes. After the system is thoroughly flushed, cap all risers.
- E. Repairs required due to vandalism before final acceptance will be performed at the contractor's expense.
- F. Walk Through for Substantial Completion:
- 1. Before requesting a walk through for Substantial Completion the following requirements must be entirely satisfied:
 - a. The entire irrigation system shall be completely installed, flushed and satisfactorily pressure tested. If Contractor fails to notify the Architect and District Inspector for the pressure test and flushing procedures stated above then Contractor assumes full responsibility for any design modifications directed by the District during the walk through for Substantial Completion regarding pressure and flushing issues.
 - b. All valve boxes shall be branded.
 - c. Record drawings shall have been submitted to the Architect and District for review as to completeness.

- e. (4) Four Services manuals shall have been delivered to the District or District Representative.
2. Once the above requirements have been met a walk through for Substantial Completion shall be requested. The following procedures shall be used during the walk through:
 - a. Contractor shall have (2) two personnel available with radio communication for the entire length of the walk through.
 - b. All valve box lids shall be removed from valve boxes and placed faced up adjacent to the valve box prior to beginning the walk through.
 - c. The scheduling of each walk through type will be divided over several days as needed to provide adequate time to complete the review of all zones. The walk through will be divided into (2) two sections and proceed as follows:
 - 1) Visual Walk Through: This will consist of walking through the entire irrigation system and examining all components of the system without turning on zones. A punch list will be established of deficiencies in the construction and workmanship of the irrigation system as compared to the construction drawings, details, and specifications.
 - 2) Operational Walk Through: This will consist of walking through the entire irrigation system observing each zone in a fully operable condition. Valves must be activated from the automatic controller unit (Manual bleeding of individual electric control valves and drip valve assemblies will not be acceptable). A punch list will be established of deficiencies in the operation of each zone in the irrigation system evaluating but not limited to correct stationing, and flushing operation of zones as compared to the construction drawings, details, and specifications.
 - 3) Once the Walk Through for Substantial Completion has been completed the Architect will provide a copy of all punch list items to the District for review and distribution to the Contractor. It is the Contractor's responsibility to repair, replace, and adjust all items on the punch prior to requesting a final walk through.

G. Final Walk Through:

1. Before commencement of a final walk through is requested, the following requirements shall be entirely satisfied:
 - a. Each item on the walk through for Substantial Completion shall be thoroughly addressed and resolved by Contractor.
 - b. All final record drawings shall have been provided to the Architect and submitted to the District.
 - c. The maintenance manual for the project shall be completed and submitted to the District.
 - d. Controller charts for each automatic controller unit shall be completed, installed, and submitted to the District.

2. Once the above requirements are met a final walk through shall be requested. The following procedures will be used:
 - a. Contractor shall have (2) two personnel available with radio communication for the entire length of the walk through.
 - b. Only those valve box lids shall be removed from valve boxes as indicated on the walk through for Substantial Completion punch list. The valve box lids shall be placed faced up adjacent to the valve box prior to beginning the final walk through.
 - c. The final walk through shall be divided into (2) two sections and proceed as follows:
 - 1) Visual Walk Through: This will consist of walking through the punch list items created at the time of the walk through for Substantial Completion, examining all components of the system without turning on zones. Any remaining deficiencies in the construction and workmanship of the irrigation system as compared to the punch list generated at the time of the walk through for Substantial Completion, construction drawings, details and specifications will be noted.
 - 2) Operational Walk Through: This will consist of walking through the punch list items created at the time of the walk through for Substantial Completion and observing each zone in a fully operable condition. Valves shall be activated from the automatic controller unit (Manual bleeding of individual electric control valves and drip valve assemblies will not be acceptable). Any remaining deficiencies in the operation of each zone in the irrigation system including but not limited to correct stationing, and flushing operation of zones as compared to the punch list generated at the time of the walk through for Substantial Completion construction drawings, details, and specifications.
 - 3) Once the Final Walk Through is completed and all items noted on the final punch list have been addressed the maintenance period shall begin. Any additional site walks required due to Contractors' inability to address all issues on the punch lists described above will be provided at Contractor's expense.

3.15 MAINTENANCE PERIOD

- A. The Maintenance Period shall be as indicated in the Agreement and shall be 90 days or greater. It shall begin once all items on the final walk through punch list have been satisfactorily addressed by a written statement indicating such from the Architect and the District.
 1. Contractor is responsible for obtaining and following the maintenance manuals created specifically for the project from the District at the beginning of the maintenance period.
 2. Demonstrate to District's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review maintenance information.
 - a. Provide seven days' advance written notice of demonstration.

3. At the end of the maintenance period and prior to turning the project over to the District, Contractor shall deliver the following to the District:
 - a. All necessary maintenance materials.
 - b. Extra stock as specified elsewhere in this Section.
4. Once Contractor has fulfilled all maintenance agreement obligations and has provided the above items to the District, the maintenance period will end.

END OF SECTION

SECTION 32 93 00
PLANTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Planting and maintenance as indicated on the drawings and specified herein.

1.02 PERFORMANCE REQUIREMENTS

- A. Control: The selection of herbicides, application rates and methods are to be performed under the control and guidance of a licensed pest control advisor and applicator in the State of California.

1.03 QUALITY ASSURANCE

- A. Provide laboratory soils analysis conforming to the following:
1. Submit two representative samples of native soil within the project limits as soils samples to the laboratory at the commencement of work, after rough grading.
 2. Place each sample in a sturdy container, properly identified, labeled, and dated.
 3. Provide report of results to the District Representative, the Architect, and Contractor. The test shall include a fertility and suitability analysis with written recommendations for soil preparation, backfill mix, auger hole requirements, maintenance and post-maintenance fertilizer requirements. The results of this test shall supersede the amendment and fertilizer schedule specified herein and no planting shall be done until the Architect approves the soils test recommendations.
- B. Testing services shall be paid for by the Contractor.

1.04 FIELD CONDITIONS

- A. Scaled dimensions are approximate. Check and verify site dimensions and receive District Representatives approval prior to proceeding with work under this section.
- B. Coordinate installation of plant materials, to avoid interference with other construction.
- C. Maintain premises clean and free of excess equipment, materials and debris incidental to work.
- D. Protect existing facilities and work of others at times in performance of work.
- E. Carefully note all finish grades before commencing work. Restore finish grade changed during course of this work to original or intended grades.

1.05 QUALITY ASSURANCE

- A. Inspections: Plants shall be subject to inspection and acceptance at place of growth or upon delivery to the site, for quality, size and variety. Such acceptance shall not impair the right of inspection and rejection at a later time or during progress of work, for size, condition of rootball, and latent defects or injuries. Immediately remove rejected plants from the site. Trees, 24 inch box size and larger, shall be accepted by the District Representative prior to delivery.

- B. The following inspections shall be made by District Representative. Request inspection in writing at least two working days in advance of the time inspection is required:
 - 1. Plant material placement prior to installation.
 - 2. Preparation of Punch List prior to maintenance period.
 - 3. Final observation for completion.
- C. The Contractor, or his authorized representative, shall be on site at the time of each inspection.
- D. If the Contractor requests an inspection and the site is not in an acceptable condition to hold the inspection, the hourly fees of the personnel called for the inspection shall be paid by the Contractor. No site visits will be scheduled until these fees have been paid.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Submit at time of delivery invoice statements certifying quantities by bulk and/or weight, for all organic amendments and fertilizers. Submit suppliers' certificates of compliance with these specifications. Random samples may be taken by the District Representative for analysis.

1.07 GUARANTEE AND REPLACEMENT

- A. Plantings: Guarantee planting until end of maintenance period and acceptance. Replace trees or plants that die or lose form and size as originally specified even though they have taken root and are growing after the dieback or loss of form or size.
- B. Trees: Guarantee 15 gallon trees and larger, in writing, to live in a healthy condition for one year after final inspection and acceptance by the District. Replace dead or unhealthy trees immediately. Replacements, including planting, staking, training, etc., shall be as originally specified, without cost to the District.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide materials of best quality obtainable, which comply strictly with Drawings and specifications.

2.02 SOIL AMENDMENTS (for bidding – prior to soils report)

- A. Organic Amendment: Derived from wood or bark, granular in nature, stabilized with nitrogen and fortified with minerals, and having the following properties:
 - 1. Organic Content: Minimum 90% by weight.
 - 2. Particle Size: Minimum 95% passing 4 mesh screen; Minimum 80% passing 8 mesh screen.
 - 3. Nitrogen Content: 0.5% based on dry weight for redwood sawdust. 0.7% based on dry weight for fir sawdust. 1.0% based on dry weight for fir or pine bark. NOTE: Pine sawdust is not acceptable.
 - 4. Mineralized: 0.1% total iron.
 - 5. Salinity: Maximum conductivity 3.5 mm/cm at 25 degrees C.
- B. Fertilizer and Minerals:
 - 1. Soil sulfur: Minimum 95% elemental sulfur.

2. Ferric Sulfate: Fe₂ (SO₄)₃ minimum 20% Fe, as metallic.
3. Commercial Fertilizer:
 - 38-0-0 Urea formaldehyde (Soil preparation)
 - 12-12-12 (Soil preparation)
 - Ammonium sulfate 21-0-0 (Weed abatement)
 - 16-6-8 (Maintenance)
4. Planting Tablets: Gro-Power 12-8-8 slow release tablets.
5. Gro-Power Plus: 5:3:1, 50% humus, 2% soil penetrant PH 4.5 - 4.7

2.03 PLANT MATERIALS

- A. Quantity and size of plants as stated on the Plans and Plant Legend. No root bound materials allowed. Plants shall be fresh and vigorous, of normal growth, and free of diseases, weeds, harmful insects, or their insect eggs and larvae.
- B. Plants are subject to inspection for approval or rejection at place of growth and/or on project site at any time before or during progress of work for size, variety, condition, latent defects and injuries. Remove rejected plants from site immediately and replace with approved plants.
 1. Protection: Protect plants from damaging sun and wind. Damage will be cause for rejection even after initial approval.
 2. Substitutes: Not permitted unless specifically approved in writing.
 3. Nomenclature: Conforms to customary nursery usage.
 4. Quantities: Provide materials as needed to complete indicated work.

2.04 STAKING MATERIALS

- A. Tree Stakes: Sound treated pine and uniform size, dimension and diameter, pointed at one end. Quantity and size of stakes shall be as shown on the Drawings.
- B. Ties: Cinch-Tie or District approved equal. Secure to tree as detailed.

2.05 INERT MATERIALS

- A. Inert Mulch – Decomposed Granite:
 1. Inert mulch for planting areas and circulation areas shall be decomposed granite. It shall be clean, non-plastic, free from deleterious or foreign matter, natural or manufactured from crushed rock. Do not use limestone screenings or stone dust that do not conform to the grading requirements shown below. Color shall be as specified on the Drawings. Crushed stone sieve analysis ASTM D422 shall be as follows:

<i>SIEVE DESIGNATION</i>	<i>PERCENT PASSING</i>
3/8"	100
No. 4	95-100
No. 8 (2.36 mm)	75-80
No. 16 (1.18 mm)	55-65
No. 30 (0.600 mm)	40-50
No. 50 (0.300 mm)	25-35
No. 100 (0.150 mm)	15-20

SIEVE DESIGNATION	PERCENT PASSING
No. 200 (0.075 mm)	10-15

2. Submit inert mulch samples for planting areas and circulation areas to Architect and District's Representative for approval.
- B. Stabilizer Binder (use with decomposed granite surface):
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. Provided by: KRC Rock Inc., San Marcos, California (800) 572-7625, or District approved equal.

2.06 WEED BARRIER FABRIC

- A. Weed barrier shall be a 5.3 ounce heavyweight UV stabilized non-woven polypropylene landscape fabric, as manufactured by Phillips Fibers Corporation or District approved equal. Needle punched material is not acceptable.

2.07 WOOD BARK MULCH

- A. Landscaped or bare soil areas beneath shall be covered with 3/4 inch to 1-1/2 inch size wood bark, 3 inches minimum depth. Wood bark shall be screened. Acceptable products include, and are not limited to: Aguinaga – Forest Floor (0-2”), Plants Choice, Ecomulch.

2.08 HYDROSEED MIX(ES)

- A. Hydroseed mix(es) shall be as specified on the drawings. All seed shall be labeled and shall be furnished in sealed standard containers with duplicate signed copies of a statement from the vendor certifying that each container of seed delivered is fully labeled in accordance with the California State Agricultural Code. Seed that has become wet, moldy or otherwise damaged in transit or storage will not be acceptable.
- B. Hydroseed Slurry Components: Refer to drawings for quantity and application rate.

2.09 CHEMICAL CONTROLS

- A. Pre-emergence Herbicide: Acceptable manufacturers include, but are not limited to the following: Surflan, Treflan or Dymid
- B. Weed Contact Spray: Acceptable products include, but are not limited to: Phytar, 560 Broadside.

2.10 TREE ROOT PROTECTION

- A. Root barriers are available from, but not limited to, Deep Root Corporation and shall be as follows:
1. 15 gallon trees: #UB24 – two with 4 panels required.
 2. 24 inch box trees: #UB24 – two with 5 panels required.
 3. 36 inch box trees: #UB24 – two with 7 panels required.

PART 3 - EXECUTION

3.01 PRELIMINARY GRADING

- A. General: Do not work soil when the moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form or that clods will not break readily. Apply water if necessary to provide ideal moisture content for tilling and planting. Perform preliminary grading in such a way as to anticipate the finish grade after the installation of soil conditioners. Remove or redistribute excess soil before application of soil amendments.
- B. Finish: Grade planting areas to a level of 2 inches below the adjacent pavement surface. Where no grades are shown, grade between existing or fixed controls (such as walks, curbs, catch basins) and elevations shown to provide a smooth and continual plane. Rake and level as necessary to obtain true and even surfaces. Verify all swales on Engineer's Plan, and grade to drain.
- C. Remove and dispose of rocks over 3/4" inch diameter within top 12 inches of soil, construction debris, weeds, etc. within the limits of the project prior to applying soil amendments.

3.02 SOIL PREPARATION FOR LEVEL PLANTING AREAS

- A. Quantities: The following amendments are for bidding purposes only. Actual quantities and mixes shall be determined in accordance with the soils report obtained per Item 1.03 above. Uniformly apply to each 1,000 square feet of planting area:
 - 50 pounds 'Gro-Power Plus'
 - 6 cubic yards on-site soil
 - 15 pounds soil sulfur
 - 8 pounds 12-12-12
- B. Distribution: Distribute the organic amendment and fertilizer over the planting area to a uniform depth of 2 inches. Secure approval from District Representative prior to working amendments into soil. No credit for organic amendment will be given if this procedure is not used.
- C. Cultivation: Work into soil by cultivation, spading or rototilling to a depth of at least 6 inches. Finish grades to smooth finish 2 inches below adjacent paving and curbs. Remove debris and weeds from site.

3.03 BACKFILL MIX

- A. Stockpile a sufficient quantity of approved soil found on site, free of weeds and debris, for mixing as backfill material. Supplement on-site soil with approved import soil, as required. Mix amount for 10 cubic yards as follows: Note: The following amendments are for bidding purposes only. Actual quantities and mixes shall be determined in accordance with the Soils Report obtained per Item 1.03 above.
 - 6 cubic yards on-site soil
 - 4 cubic yards organic amendment
 - 20 pounds ferric sulfate
 - 10 pounds 12-12-12

180 pounds 'Grow-Power Plus'

- B. Use care not to stain concrete with ferric sulfate. Cleaning of stained concrete is the responsibility of Contractor.

3.04 WEED ERADICATION

- A. Perform the following procedures for irrigated planting areas:
 1. Spot spray perennial weeds with a non-selective systemic contact herbicide. "Round-Up" or District approved equivalent.
 2. Manually remove remaining covers and weeds, and dispose off-site.
 3. Fertilize planting areas with Ammonium Sulfate at 4 lbs./1000 s.f. or equivalent fertilizer to promote re-growth.
 4. Apply irrigation at a rate sufficient to promote weed growth for a period of 2 to 3 weeks.
 5. When weed seeds have germinated and grown to a height of 2 inches, discontinue irrigation for a period of three (3) days to prepare the areas for access.
 6. Spray weeds with a non-selective contact herbicide, and spray Bermuda Grass and Morning Glory with a non-selective systemic herbicide. Apply no water for a minimum of four (4) days following application of contact weed killer.
 7. Allow a sufficient period of time to ensure that weeds are dead. Follow herbicide manufacturer's directions.
 8. Lightly irrigate planting areas for a period of 2 to 3 weeks, without causing erosion of soils.
 9. Spot spray weed re-growth with non-selective contact herbicide.
 10. Plant container stock (no rooted cuttings).
 11. Evenly distribute specified soil amendments to areas.
 12. Water planting areas for three (3) consecutive days to moisten upper layers of soil prior to hand seeding operation without causing erosion to the soils.
 13. Allow planting area soil surface to dry out for one day only prior to the hand seeding application. Do not allow the soil surface to be super saturated with water or excessively dry prior to hand seeding. Verify that residual moisture lies within the first 1/2-inch of the soil surface.
 14. Plant rooted cuttings and hand seed areas as specified.

3.05 PLANTING

- A. Pre-Plant Approvals: Obtain approval of planting holes, pre-mixed backfill, plants, and locations prior to planting.
 1. Trees and shrubs shall not be planted until construction work in the area has been completed, final grades established, and the planting areas properly graded and prepared.
 2. Stake plant locations or place approved quantities of plants in containers on locations. Secure approval before excavating pits, making necessary adjustments as directed.

3.06 INSTALLATION

- A. Install plant materials as soon as site is available and weather conditions are suitable. Do not plant when weather conditions are unfavorable to do good work, or if soil is excessively wet. Protect plants from sun, wind and rain at all times prior to and during planting.
 1. Excavate pits with scarified vertical sides and bottom, no smaller than the following sizes:

- 1 Gallon plants - 8" deep, 12" in diameter
- 5 Gallon plants - 12" deep, 24" in diameter
- 15 Gallon plants - 18" in diameter
- Boxed Trees - depth of rootball - 24" wider than rootball

2. Partially refill hole to a height that when a plant is placed, the crown is slightly above the finished grade to allow for decomposed granite cover. Use friable un-amended soil for all boxed trees, specified backfill mix for other container plants, and tamp to compact.
 3. Fill hole with water prior to installing plant.
 4. Deposit Gro-Power 12-8-8 tablets in plant pits as described in planting notes.
 5. Set plants in center of pits in vertical position so that the crown of plant is slightly above the finished grade, and backfill with prepared backfill mix.
 6. Form shallow basin around edge of plant ball by depressing soil slightly below finished grade. Form basin rims. Keep basin within outer edges of plant ball.
 7. Individually hand water each plant to saturate rootball and adjacent soil immediately after planting.
 8. Adjust for settlement and grade areas around plants to finish grades and dispose of excess soil.
 9. Stake trees designated with stake or stakes on windward side of tree as detailed.
- B. Irrigation: A sprinkler system is provided in areas for maintaining general moisture requirements. Hand watering of newly planted trees and shrubs will; however, be required once every week for three weeks. Check plants for adequate moisture at the roots. Water as required throughout the maintenance period.

3.07 WOOD BARK MULCH

- A. Install bark mulch in all shrub areas. Depth shall not exceed 3". Contractor to insure that specified mulch depth is maintained through the maintenance period. Contractor shall replenish mulch, if required, prior to acceptance by the District.

3.08 HYDROSEEDING

- A. Hydro-seeding shall be applied in the areas indicated and in accordance with mix indicated.
- B. Hydro-seeding Equipment: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood pulp or fiber shall be of the "Super Hydroseeder" type. This equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing 1,200 pounds of mulch and seed. The slurry distribution lines shall be large enough to prevent stoppage and shall provide even distribution of the slurry. The slurry tank shall have a minimum capacity of 1,350 gallons and shall be mounted on a traveling unit that will place the slurry tank and spray nozzles within sufficient proximity to the areas to be sprayed so as to provide uniform distribution without waste.
- C. Application Method: Using the wood pulp as a guide, spray the soil with a uniform visible coat of slurry. The slurry shall be applied in a sweeping motion, in an arched stream, so as to fall like rain allowing the wood fibers to build upon each other, until a complete, even coverage coat is achieved.

- D. Hydro-seeded areas shall be kept moist at all times 20-24 days after planting or until the new growth of the plants are sufficiently well established.
- E. Hydro-seeded areas shall be protected against foot traffic and other use immediately after application is completed. Contractor shall place warning signs and temporary twine and flagging around the areas.
- F. Re-hydro-seeding of bare areas shall be done 30 days after initial application.
- G. Hydroseeded Turf:
 - 1. The establishment of turf includes all the work normally required to establish, and to grow a healthy, uniform turf of smooth and even textures and grades.
 - 2. Between the 15th and 20th days of the maintenance period, re-hydroseed all spots or areas in which normal rooting is not evident.
 - 3. Within the first 20 days of maintenance period:
 - a. Remove all rocks or other debris that would constitute a hindrance to subsequent mowings or present an untidy appearance.
 - b. Repair all damage caused in performance of work.
 - c. Fill all depressions and eroded channels with sufficient backfill mix to raise to proper grade.
 - d. Roll all lawn areas with a roller weighing approximately 16 pounds per lineal inch to compact the soil around the roots and provide a smooth, even mowing surface.
 - e. Mow turf with a reel mower when it reaches height of 3/4 of an inch. Mow to a height of 1/2 inch and repeat as turf re-grows. Remove all cuttings.
 - f. Core five 1-inch diameter holes to a depth of 18-inches with a soil probe evenly spaced at the dripline of each tree. Do not remove turf to create basins around trees in lawn areas.

3.09 MAINTENANCE

- A. Maintenance shall begin immediately after each plant is planted and shall continue for at least 90 days after acceptance of completion of landscaping and irrigation and as much longer as is necessary to establish thriving plants.
- B. Irrigation Maintenance:
 - 1. Review existing system with District personnel for satisfactory operation and coverage.
 - 2. Properly and completely maintain irrigation systems, clean lines, valves, heads and other portions of such systems to assure their continual proper operations. Lubricate as needed.
 - 3. Make adjustments necessary to avoid overspray onto buildings and pavements.
 - 4. Program controller on a weekly basis considering weather, the water requirements of each sectional valve, and the application rate each area is capable of receiving, without runoff.
 - 5. Coordinate irrigation activities with District personnel. Specify programming and shut down for repairs.
- C. Planting Maintenance:

1. Fertilization: Apply 6 pounds per 1,000 square feet of 16-6-8 commercial fertilizer to planting areas 20 and 50 days after planting.
2. Cultivation and Weeding: After period of more or less continuous watering, during which soil moisture is maintained at near saturation point, cultivate all ground cover areas by scarifying the surface 1 inch. Do not change grade, remove basins or berms in the process of such cultivation. Follow the cultivating by a period of non-irrigation, to aid the killing off of weeds, and soil aeration.
3. Pruning and Staking: Unless otherwise directed, prune only to remove dead or broken branches of trees or shrubs. Re-stake, re-align and re-tie all trees as necessary.
4. Insect Management: Examine all plants frequently, especially any which are subject to common insect depredation such as aphids, mealy bugs, ants, etc., to establish need for counter measures. Wash foliage with strong streams of water. Notify the Owner's representative if further measures seem warranted.
5. Replacement: Immediately replace and plant materials which for reason are damaged or die during the maintenance period. Replace as originally specified.
6. Protection: Protect planting against damage, including erosion, rodents, and trespass, providing proper safeguards as needed. Repair damage to the work made by pedestrians, animals, vehicular traffic, or other cause until acceptance.
7. Mowing: Mow turf areas with rotary or reel type mowers per turf supplier's recommendation. Provide a final mowing one day prior to final maintenance period inspection.

3.10 CLEANING

- A. Upon completion of construction, and before final acceptance, broom-clean the entire area within the contract limits. Remove tools, surplus materials, equipment, debris, etc. and leave the site in a neat and acceptable condition.
- B. Paved Areas: Clean paved areas of debris or silt by sweeping and hosing.

3.11 SITE REVIEW

- A. Final review (to ensure that fire department appliances are not obstructed) of all planting will be made at the conclusion of the maintenance period. Submit written notice to District Representative at least seven days before acceptance date.

END OF SECTION

**SECTION 33 01 10.58
DISINFECTING OF SITE WATER DISTRIBUTION PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 14 16.
- B. Disinfection of building domestic water piping specified in Division 22.
- C. Testing and reporting results.

1.02 RELATED REQUIREMENTS

- A. Section 33 14 16 - Site Water Distribution Piping.

1.03 REFERENCE STANDARDS

- A. AWWA C651 - Disinfecting Water Mains.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Test Reports: Indicate results comparative to specified requirements.
- C. Certificate: From authority having jurisdiction indicating approval of water system.
- D. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- E. Disinfection report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- F. Bacteriological report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.

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- 7. Certification that water complies, or fails to comply, with bacterial standards of County Health Department.

1.05 QUALITY ASSURANCE

- A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.
- B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of California.
- C. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, AWWA B303 Sodium Chlorite, AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, AWWA B303 Sodium Chlorite, AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, AWWA B303 Sodium Chlorite, AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, and AWWA B303 Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system and water well has been cleaned, inspected , and pressure tested.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

- A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.
- B. Provide and attach equipment required to perform the work.
- C. Inject treatment disinfectant into piping system.
- D. Maintain disinfectant in system for 24 hours.
- E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- F. Replace permanent system devices removed for disinfection.
- G. Pressure test system to 120 psi. Repair leaks and re-test.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.

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B. Test samples in accordance with AWWA C651.

END OF SECTION

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**SECTION 33 05 43
CORROSION PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protection of all underground utilities from corrosion.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures, reports, coordination.
- B. Section 33 14 16 - Site Water Distribution Piping.
- C. Section 33 31 13 - Site Sanitary Sewerage Piping.
- D. Section 33 41 00 - Subdrainage.
- E. Section 33 42 11 - Stormwater Gravity Piping.
- F. Section 33 52 16 - Gas Hydrocarbon Piping.

1.03 REFERENCE STANDARDS

- A. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- B. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- C. AWWA C200 - Steel Water Pipe, 6 In. (150 mm) and Larger.
- D. AWWA C222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.
- E. AWWA C215 - Extruded Polyolefin Coatings for Steel Pipe.
- F. AWWA C214 - Tape Coating Systems for the Exterior of Steel Water Pipelines.
- G. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.
- H. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
- I. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop Applied.
- J. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- K. AWWA C217 - Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings.
- L. ACI 318 - Building Code Requirements for Structural Concrete.
- M. NACE SP0169 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- N. NACE SP0286 - Electrical Isolation of Cathodically Protected Pipelines.
- O. SSPC-SP 6 - Commercial Blast Cleaning.

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1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of corrosion protection 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 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. Test Reports: Indicate electrical continuity.
- D. Manufacturer's Field Reports: Indicate procedures followed and supplementary instructions given.

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 minimum three years of documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. 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. Deliver products to project site in unopened packaging until ready for installation.
- B. Store components under a dry covered area and elevated above grade.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 APPLICATIONS / SYSTEM DESCRIPTION

- A. Steel Pipe or Valve Assemblies:
 - 1. Implement all the following measures:
 - a. Underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints should be bonded for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.

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- b. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried steel pipeline per NACE SP0286 from:
 - 1) Dissimilar metals.
 - 2) Dissimilar coated piping (cement-mortar vs. dielectric).
 - 3) Above ground steel pipe.
 - 4) All existing piping.
- c. Choose one of the following corrosion control options:

OPTION 1

- 1) Apply a suitable dielectric coating intended for underground use such as:
 - (a) Polyurethane per AWWA C222; or
 - (b) Extruded polyethylene per AWWA C215; or
 - (c) A tape coating system per AWWA C214; or
 - (d) Hot applied coal tar enamel per AWWA C203; or
 - (e) Fusion bonded epoxy per AWWA C213.
- 2) Apply cathodic protection to steel piping as per NACE SP0169.

OPTION 2

- 3) As an alternative to dielectric coating and cathodic protection, apply a 3 inch cement mortar coating per AWWA C205 or encase in Type V - Sulfate Resistant concrete 3 inches thick, using any type of cement. Joint bonds, test stations, and insulated joints are still required for these alternatives.

2. NOTE: Some steel piping systems, such as for oil, gas, and high-pressure piping systems, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.

B. Iron Pipe or Valve Assemblies:

1. Implement all the following measures:

- a. Choose one of the following corrosion control options:

OPTION 1

- 1) Apply a suitable coating intended for underground use such as:
 - (a) Polyethylene encasement per AWWA C105/A21.5; or
 - (b) Epoxy coating; or
 - (c) Polyurethane; or
 - (d) Wax tape.

2) NOTE: The thin factory-applied asphaltic coating applied to ductile iron pipe for transportation and aesthetic purposes does not constitute a corrosion control coating.

- 3) Apply cathodic protection to cast and ductile iron piping as per NACE SP0169.

OPTION 2

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- 4) As an alternative to coating systems described in Option 1 and cathodic protection, Type V - Sulfate Resistant concrete encase all buried portions of metallic piping so that there is a minimum of 3 inches of concrete cover provided over and around surfaces of pipe, fittings, and valves using any type of cement.

C. Copper Tubing:

1. Protect buried copper tubing by one of the following measures:
 - a. Installation of a factory-coated copper pipe with a minimum 25-mil thickness. The coating must be continuous with no cuts or defects.
 - b. Installation of 12-mil polyethylene pipe wrapping tape with butyl rubber mastic over a suitable primer. Protect wrapped copper tubing by applying cathodic protection per NACE SP0169.

2.02 MATERIALS

A. Factory Coated Potable Water Copper Piping:

1. Coating: Polyethylene.
2. Thickness: 25 mils on 5/8 inch pipe.
3. Copper Pipe: Type as indicated in Division 22 and 33.
4. Manufacturers:
 - a. Kamco Products Limited; Aqua Shield™;: www.kamcoproducts.com.
 - b. Mueller Industries; Streamline Protec™: www.muellerindustries.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Factory Coated Natural Gas and LP Gas Copper Piping:

1. Coating: Linear Low Density Polyethylene LLDPE Extrusion Resin.
 - a. Additional Outer Sleeve Option: Black HDPE Outer Sleeve.
2. Thickness: 25 mils on 5/8 inch pipe.
3. Copper Pipe: Type as indicated in Division 22, 23, and 33.
 - a. Type L, ASTM B88.
 - b. REF Type, ASTM B280.
4. Manufacturers:
 - a. Kamco Products Limited; Gas-Tec™: www.kamcoproducts.com.
 - b. Mueller Industries; Streamline Protec™: www.muellerindustries.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Tape Coating System:

1. Basis of Design: Polyken manufacture by Berry Plastics Corporation, www.berryplastics.com or approved equal..
2. Provide straight pipe sections with a four layer polyethylene tape system, where not factory coated:

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- a. Products:
 - 1) Primer: 1027 Butyl Liquid Adhesive and Primer
 - 2) Filler tape: 939
 - 3) Weld stripping tape: 933-25 black
 - 4) Inner layer tape: 989-20 black
 - 5) Middle layer tape: 955-30 gray
 - 6) Outer layer tape: 956-30 white
 - b. Primer layer.
 - c. Filler tape, extruded butyl rubber compound compatible with the primer and tape.
 - d. Weld stripping tape, if required (25 mils).
 - e. Inner layer, corrosion protection tape (20 mils).
 - f. Middle layer, mechanical protection tape (30 mils).
 - g. Outer layer, mechanical protection tape (30 mils) with ultraviolet light stabilizers.
 - h. Total system thickness shall be at least 80 mils.
 - i. Provide coating materials supplied by a single manufacturer, and shall have a successful application and service history on pipe fabricated in accordance with AWWA C200.
3. Provide fittings, specials, and field joints with a three layer polyethylene tape system:
- a. Products:
 - 1) Primer: 1027 Butyl Liquid Adhesive and Primer
 - 2) Filler tape: 939
 - 3) Inner layer tape: 930-50 black
 - 4) Outer layer tape: 955-30 white
 - b. Primer layer
 - c. Filler tape, extruded butyl rubber compound compatible with the primer and tape.
 - d. Inner layer, corrosion protection tape (50 mils).
 - e. Outer layer, mechanical and ultraviolet light protection tape (30 mils).
 - f. Total system thickness shall be at least 80 mils.
 - g. The coating materials shall be supplied by the same manufacturer as the materials for straight pipe.
4. Storage of Materials: Store materials within the temperature ranges specified for application, using heated storage areas if necessary. Tape shall be stored at a minimum temperature of 70 degrees F
- D. Mortar Coating:
- 1. Thickness: 1 inch thick reinforced mortar coating over the tape coat system.
 - 2. Mortar Coating: Comply with AWWA C205.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that piping is installed correctly and tested.

3.02 CORROSION PROTECTIVE COATING APPLICATION

- A. Comply with NACE SP0169.
- B. Steel Pipe or Valve Assemblies:
 - 1. Implement all the following measures:
 - a. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
 - 1) At each end of the pipeline.
 - 2) At each end of all casings.
 - 3) Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
 - b. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried steel pipeline per NACE SP0286 from:
 - 1) Dissimilar metals.
 - 2) Dissimilar coated piping (cement-mortar vs. dielectric).
 - 3) Above ground steel pipe.
 - 4) All existing piping.
- C. Iron Pipe or Valve Assemblies:
 - 1. Implement all the following measures:
 - a. Electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulating joints per NACE SP0286. (e.g.; Flange Isolation Joint Kits. This is especially important for fire risers.)
 - b. Bond all nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.
 - c. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
 - 1) At each end of the pipeline.
 - 2) At each end of any casings.
 - 3) Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
- D. Copper Tubing:
 - 1. Protect buried copper tubing by one of the following measures:

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- a. Prevention of soil contact. Soil contact may be prevented by placing the tubing above ground or encasing the tubing using PVC pipe with solvent-welded joints.
 - b. Installation of a factory-coated copper pipe with a minimum 25-mil thickness. The coating must be continuous with no cuts or defects.
 - c. Installation of 12-mil polyethylene pipe wrapping tape with butyl rubber mastic over a suitable primer. Protect wrapped copper tubing by applying cathodic protection per NACE SP0169.
- E. Plastic and Vitrified Clay Pipe
- 1. No special precautions are required for plastic and vitrified clay piping placed underground from a corrosion viewpoint.
 - 2. Protect all metallic fittings and valves with wax tape per AWWA C217 or epoxy.
- F. All Pipe or Valve Assemblies:
- 1. On all pipes, appurtenances, and fittings not protected by cathodic protection, coat bare metal such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.
 - 2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.
- G. Concrete
- 1. From a corrosion standpoint, any type of cement may be used for concrete structures and pipe because the sulfate concentration is negligible, 0 to 0.1 percent. ACI 318, Table 19.3.2.1.
 - 2. Standard concrete cover over reinforcing steel may be used for concrete structures and pipe in contact with these soils due to the low chloride concentration found on-site. (Design Manual 303: Concrete Cylinder Pipe. Ameron. p.65)

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Tape Application:
 - 1. Tape coating materials shall be applied in accordance with this Section, the product application instructions of the tape manufacturer, and the field technical support instructions from the manufacturer.
 - 2. Weld Surface Preparation:
 - a. To provide for an effective, long-term bond between the tape coating system and the substrate, the following pipe weld surface preparation shall be provided.
 - 1) Weld surfaces with a reinforcement greater than 1/32-inch and all longitudinal and coil splice welds shall be ground to provide a smooth surface with a reinforcement not exceeding 1/32-inch. The resulting weld surface shall have a cross-section shape that is free of discontinuities, abrupt changes in curvature, with no ridges or valleys that may promote bridging or disbondment of the tape from the substrate.

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- b. Weld Stripping Tape: Provide weld stripping tape, 6 inches wide, if any of the following conditions are present. Apply tape with the center of the tape at the weld.
 - 1) If elected to use stripping tape in lieu of grinding or part of the grinding required above. In such a case, the weld reinforcement is not to exceed 3/32-inch, and the weld surface shall have a cross-section shape that is free of discontinuities, abrupt changes in curvature, with no ridges or valleys that may promote bridging or disbondment of the tape from the substrate.
 - 2) If the initial pipe sections taped have indications that the inner tape layer is not bonding completely to the pipe at the welds.
 - 3) If the tape bond to the welds or adjacent surfaces is less than the tape bond to the pipe surface away from the welds.
 - c. Welds that have been prepared with a reinforcement not exceeding 1/32-inch, and a cross section slope that is free of discontinuities, abrupt changes in curvature, with no ridges or valleys that may promote bridging or disbondment of the tape from the substrate require no additional preparation.
3. Pipe Surface Preparation:
- a. Detergent clean surfaces to be coated in accordance with SSPC-SP1 prior to abrasive blasting.
 - b. Remove all burrs, sharp edges, and weld splatter prior to abrasive blasting.
 - c. Abrasive blast immediately before application of the primer.
 - 1) Use sand, metallurgical slag, or a combination of steel grit and shot to produce a surface in conformance with SSPC-SP 6.
 - 2) Steel grit shall comprise at least 60 percent of the working mix of abrasive, if a centrifugal wheel abrasive blaster is used.
 - 3) The prepared surface shall have a surface profile not exceeding 2 mils.
 - d. Apply abrasive blasting and primer application when the substrate surface is at least 5 degrees F above the dew point.
 - 1) Provide abrasive blasting, priming, and inner layer tape application during the same working day for each pipe section.
4. Pipe End Preparation:
- a. Coating cut-backs at the pipe ends: 6 inches, with the cuts parallel to the pipe ends.
 - 1) Protect exposed substrate surfaces with a storage primer applied immediately after taping and before flash rusting of the surface.
 - b. Spiral or longitudinal pipe welds within two feet of the pipe ends shall be ground flush prior to abrasive blast cleaning.
 - c. Pipe ends that will be connected with sleeve-type couplings shall be epoxy coated for immersion service.
 - 1) Cut-Backs: Minimum 6 inches at couplings to provide clearance between the coupling and tape.

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- 2) Epoxy Coating: Extend minimum 6 inches beyond each side of the sleeve coupling on the outside surface of the pipe.
5. Application of Tape:
- a. Maintain pipe shell temperature within a range of 45 degrees F to 100 degrees F during application of the tape system.
 - b. Maintain inner layer tapes a minimum temperature of 70 degrees F during application.
 - 1) Maintain middle and outer layer tapes at a minimum temperature of 90 degrees F during application.
 - c. Tape Application Tension: Maintained at a value that produces a tape width reduction equal to 1.0 to 2.0 percent of the tape width during application, as recommended by the tape manufacturer. Maintain width reduction simultaneously with the minimum tape temperature.
 - d. At the point of tape application, all tape, including weld stripping tape, press onto the pipe with a pressure roller that maintains a constant pressure. Use enough pressure to fully bond the tape at all welds.
 - e. Filler tape shall be used at lap joints, weld step-downs, and other discontinuities.
 - f. The tape application equipment and materials shall result in a fully bonded tape coating system, without blisters, voids, wrinkles or any areas that have a lack of bond to the pipe.
 - g. Succeeding layers of tape shall be applied so that the laps are staggered by at least two inches.
 - h. Before tape application, the primer shall be dried sufficiently so that the primer is in a tacky to dry condition.
 - i. Primer: Apply while it is in a temperature range of 50 degrees F to 80 degrees F, using airless spray equipment and a drum agitator. Application shall be of uniform thickness on all pipe surfaces.
6. Repair Patches
- a. Repair patches shall be applied by wrapping tape completely around the pipe, using the tape system for joints.
7. Tape Application to Fittings, Specials:
- a. Filler tape shall be used to fill voids on fittings, specials, welds, and pipe joints.
 - b. All bell and spigot joints, lap joints, and other locations where voids will otherwise exist: Provide specially shaped, filler tape applied after priming.
 - c. Field pipe joints shall be prepared as required by the paragraph entitled "Pipe Surface Preparation," except that shop blasted surfaces that have been coated with a storage primer or an epoxy coating may be power tool cleaned instead of abrasive blast cleaned. The power tool cleaning shall be done in accordance with SSPC-SP2. Pipe ends not effectively protected with a storage primer shall be abrasive blasted to SSPC-SP6.

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3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Test for electrical continuity in accordance with NACE SP0286.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.06 PROTECTION

- A. Protect installed coatings from subsequent construction operations.

END OF SECTION

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SECTION 33 14 16
SITE WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water pipe for site conveyance lines.
- B. Pipe valves.
- C. Fire hydrants.
- D. Site water lines up to approximately 5 feet from the building perimeter. See individual building systems for continuation.

1.02 RELATED REQUIREMENTS

- A. Section 21 11 00 - Facility Fire-Suppression Water-Service Piping.
- B. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Underground fire line extension into the building.
- C. Division 22 - Plumbing: Underground water line extension into the building.
- D. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- E. Section 33 01 10.58 - Disinfecting of Site Water Distribution Piping: Disinfection of site service utility water piping.
- F. Section {id\#1000026} - {t\#1000026}: Reducing exposure of metal parts in sulfate containing soils.

1.03 REFERENCE STANDARDS

- A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- B. ASTM A506 - Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- D. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- E. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
- F. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- G. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- H. ASTM F594 - Standard Specification for Stainless Steel Nuts.

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- I. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- J. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- K. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
- L. AWWA C504 - Rubber-Seated Butterfly Valves.
- M. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS.
- N. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
- O. AWWA C606 - Grooved and Shouldered Joints.
- P. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm).
- Q. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- R. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.
- S. UL 246 - Hydrants for Fire-Protection Service.

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.
- B. 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 on pipe materials, pipe fittings, joints, couplings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - 1. Submit a certificate stating that the meters have been tested and that the accuracy and capacity meet the requirements of AWWA C700 when tested in accordance with AWWA Standards according to type installed.
- D. Shop Drawings: Submit shop drawings for potable water system, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- E. Certificates: Provide a NFPA 24 Certificate of installation with copies for District, Architect, local fire officials, and DSA.
- F. Project Record Documents:
 - 1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

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- 3. On a set of Contractor Drawings, kept at the site during construction, mark construction that is installed differently from that indicated.
 - a. Locate materials installed underground by dimensions from fixed identifiable points whether installed as indicated or not.
- G. Maintenance Data:
 - 1. Submit maintenance data and parts list for potable water system materials and products.
 - 2. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Section 01 78 00 - Closeout Submittals.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with utility company requirements.
- B. Manufacturer's Qualification: Firms regularly engaged in manufacture of potable water system materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with potable water piping work similar to that required for project.

1.07 REGULATORY REQUIREMENTS

- A. Materials and installation: Comply with the following documents hereinafter referred to as the "SSPWC (Greenbook)".
- B. Install in accordance with County of Los Angeles Fire Department Regulation 8.
- C. Comply with NFPA 24 as adopted by authority having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.
- B. Do not store materials directly on the ground. Support the pipe uniformly during shipping and storage.
 - 1. Do not stack higher than 4 feet nor stack with weight on bells.
 - 2. Cover plastic pipe to protect it from sunlight.
 - 3. Keep inside of pipe and fittings free of dirt and debris.
 - 4. Avoid scratching the pipe surface.
- C. Do not install pipe that is cracked, broken, gouged, scratched or forming a clear depression. Remove damaged pipe from the site.
- D. Do not install pipe contaminated with a petroleum product or any other toxic material whether inside or outside of pipe.
- E. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged.
 - 1. Hoist pipe with mechanical equipment using a cloth belt sling or a continuous fiber rope which avoids scratching the pipe.
 - 2. Pipes may be lowered by rolling on two ropes controlled by snubbing.

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1.09 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 SITE FIRE LINE SYSTEM DESCRIPTION

- A. CFC 507 and 901 with NFPA Compliance: NFPA 24.
 - 1. Coordinate installation with sprinkler risers at building to match requirements with NFPA 13.
- B. Local Fire Department/Fire Marshal Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.
- C. UL Compliance: Provide fire hydrants that comply with UL 246, and are listed by UL, and approved by the authorities having jurisdiction.

2.02 WATER PIPE

- A. General:
 - 1. Provide piping materials and factory-fabricated piping products of size, type, pressure ratings, and capacities as indicated.
 - 2. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.
 - 3. Provide size and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems.
 - 4. Where more than one type of materials or products are indicated, selection is Installer's option.
- B. Piping:
 - 1. Provide pipes of one of the following materials, of weight/class indicated.
 - 2. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
- C. Ductile Iron Pipe: AWWA C151/A21.51:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, rubber gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- D. PVC Pipe: ASTM D 1785, Schedule 80 for sizes 1/2 inch through 3 inches.
 - 1. Fittings: ASTM D2466, PVC, socket type, solvent cement joints; or elastomeric gaskets joints.
 - 2. Joints: ASTM D2855, solvent weld.
- E. PVC Pipe: AWWA C900 FM approved, Class 305 (formerly 200): for sizes 4 inches through 12 inches; UL Listed.

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1. Dimension Ratio: DR 25.
 2. Fittings: AWWA C111/A21.11, ductile-iron, cement lined, with rubber gaskets.
 3. Joints: ASTM D3139 compression gasket ring, bell and spigot.
- F. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.03 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches:
1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.
- C. Gate Valves 3 Inches and Over:
1. Manufacturers:
 - a. Mueller Co.
 - b. Decatur
 - c. Illinois
 - d. Kennedy Valve Div.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 2. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.
- D. Ball Valves Up To 2 Inches:
1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.
- E. Swing Check Valves From 2 Inches to 24 Inches:
1. Manufacturers:
 - a. Clow Corp.
 - b. Fairbanks Co.
 - c. Kennedy Valve Div.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
- F. Butterfly Valves From 2 Inches to 24 Inches:
1. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten position lever handle.
- G. Valve Ends: Provide flanged, threaded, hub or sleeve type mechanical joint ends designed to suit pipe or tapping sleeves connections.

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2.04 HYDRANTS

- A. Hydrants: Type as required by local Fire Department or utility company.
 - 1. Fire Service Hydrant:
 - a. Outlets:
 - 1) 4 inch diameter: One.
 - 2) 2-1/2 inch diameter: One.
- B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.
- C. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles , one pumper nozzle.
- D. Fire Department Connections: As required by Fire Department having jurisdiction and responsibility for serving site.
- E. Finish: Primer and two coats of enamel in color required by local Fire Department or utility company.

2.05 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 23 23.
- B. Cover: As specified in Section 31 23 23.

2.06 ACCESSORIES

- A. Bolts and Nuts for Flanges: Provide type 316 stainless steel (UNS s31600 / AISI 316 / ASTM A240/A240M) for all bolts, nuts washers and rods used for the installation of underground piping, valves and fittings.
 - 1. Bolts: Conform to ASTM F593, Alloy Group 2, Condition CW1 (1/4 to 5/8 inch) and CW2 (3/4 to 1-1/2 inch).
 - 2. Nuts: Conform to ASTM F594, Alloy Group 2, Condition CW1 (1/4 to 5/8 inch) and CW2 (3/4 to 1-1/2 inch).
- B. Restraint Devices: Provide wedging action type mechanical restraint devices at all pipe joints.
 - 1. Rods, Nuts and Washers: Stainless Steel per ASTM F593 and ASTM F594.
 - 2. Products:
 - a. EBAA Iron Sales, Inc.: ebaa.com.
 - b. Uni-flange type.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
 - 1. Clamps, Straps, and Washers: Stainless Steel, ASTM F594.
 - 2. Rods: Stainless Steel, ASTM F593.
 - 3. Bolts: Stainless Steel, ASTM F593.

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- D. Concrete: Ready-mixed, complying with ASTM C94/C94M; Type V - Sulfate Resistant Portland cement; 3,000 psi strength at 28 days, 3 inch slump; 3/4 inch nominal size aggregate.
- E. Backflow Preventer: Detector check assembly
 - 1. Reduced-pressure-principle assembly consisting of shutoff valves on inlet and outlet and strainer on inlet. Assemblies shall include test cocks and pressure-differential relief valve located between 2 positive seating check valves and comply with requirements of ASSE 1013. Assemblies shall have approval of Health Department having jurisdiction.
 - 2. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following (pending approval of local water authority having jurisdiction):
 - a. Cla-Val Co.
 - b. Febco
 - c. Hersey Products, Inc.
 - d. Watts Regulator Co.
 - e. Basis of Design: Zurn Industries Inc. Wilkins Regulators Div.: Wilkins Model 375ADA Reduced Pressure Detector Assembly: www.zurn.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Meter:
 - 1. Comply with AWWA C700. Acceptable manufacturers, or equal.
 - 2. Acceptable manufacturers:
 - a. Western Water Meter Inc.
 - b. Rockwell International Corp.
 - c. Hersey Products Inc.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Water meter shall be:
 - a. Flanged multijet turbine type.
 - b. Meet requirements of local water department.
 - 4. The meter housing shall be bronze with brass case and lid.
 - 5. Meter chamber shall be molded and corrosion resistant and shall have a sapphire rotor bearing. The meter register shall be vacuum sealed in copper housing with magnetic coupling. It shall have a leak indicator and heat tempered glass.
 - 6. Concrete Meter Box: Meter boxes shall be Brooks Concrete Works Series 3 through 37 meter box, standard meter vault or 300 Series meter vault, or equal, as required by local water department.
- G. Identification
 - 1. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".

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- a. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following:
 - 1) Allen Systems Inc.
 - 2) Seton Name Plate Corp.
- b. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Nonmetallic Piping Label: If nonmetallic piping is used for water service, provide engraved plastic laminate, label permanently affixed to main electrical meter panel stating "THIS STRUCTURE HAS A NONMETALLIC WATER SERVICE".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. See the sections on excavation and fill for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe (larger than 4 inches) thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide 4 sq ft thrust restraint bearing on subsoil.
- D. Do not backfill until installation has been approved and as-built drawings are up to date. Promptly install all piping after excavation or cutting for same has been done, so as to keep the excavations open as short a time as possible.
- E. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. General: During back-filling/topsoiling of underground potable water piping, install continuous underground-type plastic line markers located directly over buried lines at 6 to 8 inches below finished grade.
- B. Maintain separation of water main from sewer piping in accordance with plumbing code.
- C. Group piping with other site piping work whenever practical.
- D. Establish elevations of buried piping to ensure not less than 2 ft of cover.

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- E. Install pipe to indicated elevation to within tolerance of 5/8 inches.
- F. Comply with Section 33 01 10.58 - 33 01 10.58.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Install grooved and shouldered pipe joints to AWWA C606.
- I. Polyvinyl Chloride Pipe: Install in accordance with manufacturer's installation instructions.
 - 1. Pressure water lines (4 inch and larger): Install in accordance with pipe manufacturers recommendations, or as shown in J-M Installation Guide "Ring-Tite PVC Pipe". Provide thrust blocks as required by "J-M Installation Guide".
- J. Route pipe in straight line.
- K. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- L. Install access fittings to permit disinfection of water system performed under Section 33 01 10.58.
- M. Slope water pipe and position drains at low points.
- N. Install trace wire 6 inches above top of pipe; coordinate with Section 31 23 16.13.
- O. Provide and install 14 gauge copper "Tracer" wire, continuous for entire length, for all underground non-metallic piping. Secure to piping at alternate joints, at each fitting and at each valve. Locate "Tracer" wire along side pipe, but not under pipe.
- P. Installation of identification: During backfilling/top-soiling of underground water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6 to 8 inches below finished grade.

3.05 INSTALLATION - VALVES AND HYDRANTS

- A. Check operation of all valves before installing. Install valves true to line and grade. Install valves in accordance with AWWA C600 and manufacturer's written instructions. Wrap all buried, ferrous metal valves with polyethylene film in conformance with Section 5-4 of AWWA C105/A21.5.
- B. Set valves on solid bearing.
- C. Install valves as indicated with stems pointing up. Provide valve box over underground valves.
- D. Center and plumb valve box over valve. Set box cover flush with finished grade.
- E. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway in accordance with Section 21 11 00.
- F. Set hydrants to grade, with nozzles at least 20 inches above ground in accordance with Section 21 11 00.
- G. Locate control valve 4 inches away from hydrant.
- H. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- I. Fire Department Connections: Install in accordance with AWWA C600 and manufacturers written instructions.

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3.06 INSTALLATION OF WATER METERS

- A. Install water meter in accordance with AWWA C600 and/or utility company's installation instructions and requirements. Check operation of all meters before operation. Install in meter boxes where indicated.
- B. Size meter and arrange piping and specialties to comply with utility company's requirements.
- C. Set meter on concrete pad as indicated. Refer to Division 32 for concrete, formwork, and reinforcing material requirements.
- D. Mount meter on wall brackets as indicated.

3.07 ROUGH-IN FOR WATER METER

- A. Install rough-in piping and specialties for water meter installation in accordance with utility company's instructions and requirements.

3.08 ANCHORAGE INSTALLATION

- A. Provide anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.

3.09 INSTALLATION OF BACKFLOW PREVENTER

- A. Install backflow preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Install air cap fitting and pipe relief outlet drain without valves to nearest floor drain. Identify all piping downstream of backflow preventers as "industrial water".
- B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet.

3.10 CORROSION PROTECTIVE COATING APPLICATION

- A. See Section 330543 - Corrosion Protection.
- B. Comply with NACE SP0169.

3.11 IDENTIFICATION INSTALLATION

- A. During backfilling/top-soiling of underground water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6 to 9 inches below finished grade.
- B. Attach nonmetallic piping label permanently to main electrical meter panel.

3.12 SERVICE CONNECTIONS

- A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves and sand strainer.
- B. Tap water main with size and in location as indicated, in accordance with requirements of City standards.
- C. Connections to Plumbing Systems: Make connections of service laterals to plumbing facilities at a location 5 feet outside the building line as indicated. Connections shall be made utilizing standard prefabricated adapters installed in accordance with the pipe manufacturer's

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recommendations.

3.13 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform field inspection and testing in accordance with Section 01 40 00.
- C. Test valves for leakage and alignment prior to backfilling.
- D. Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- E. Pressure test water piping to 200 pounds per square inch.
 - 1. PVC Water Pipelines: Test all water lines in accordance with manufacturers recommendations.
 - 2. Increase pressure in 50 psi increments and inspect each joint between increments. Hold at test pressure for one hour, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.
 - 3. Test fails if leakage exceeds 2-qts per hour per 100 gaskets or joints, irrespective of pipe diameter.
- F. Pressure test fire line water piping to 200 psi, or 50 psi in excess system working pressure, NFPA 24.
 - 1. Increase pressure in 50 psi increments and inspect each joint between increments. Hold at test pressure within +/- 5 psi for two hours, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.
- G. Fire Department Connections: On-site fire department connections shall be tested by the Contractor as directed by the Fire Department having jurisdiction. Perform all tests in the presence assigned Inspector.
- H. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.
- I. Submit the completed and approved NFPA 24 Certificate as indicated under Submittals in this section.

3.14 CLEANING

- A. Clean and disinfect water-distribution piping as indicated in Section 33 01 10.58 - Disinfecting of Site Water Distribution Piping.

END OF SECTION

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Contractor's Material and Test Certificate for Underground Piping	
PROCEDURE Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job. A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.	
Property name	Date
Property address	
Plans	Accepted by approving authorities (names)
	Address
	Installation conforms to accepted plans <input type="checkbox"/> Yes <input type="checkbox"/> No Equipment used is approved <input type="checkbox"/> Yes <input type="checkbox"/> No If no, state deviations
Instructions	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain
	Have copies of appropriate instructions and care and maintenance chart been left on premises? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain
Location	Supplies buildings
Underground pipes and joints	Pipe types and class _____ Type joint _____
	Pipe conforms to _____ standard <input type="checkbox"/> Yes <input type="checkbox"/> No Fittings conform to _____ standard <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain
	Joints needing anchorage clamped, strapped, or blocked in accordance with _____ standard <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain
Test description	<p>Flushing: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at one of the flow rates as specified in 10.10.2.1.3.</p> <p>Hydrostatic: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) or 50 psi (3.5 bar) in excess of the system working pressure, whichever is greater, and shall maintain that pressure +5 psi (0.35 bar) for 2 hours.</p> <p>Hydrostatic Testing Allowance: Where additional water is added to the system to maintain the test pressures required by 10.10.2.2.1, the amount of water shall be measured and shall not exceed the limits of the following equation (for metric equation, see 10.10.2.2.6).</p> $L = \frac{SD\sqrt{P}}{148,000}$ <p> <i>L</i> = testing allowance (makeup water), in gallons per hour <i>S</i> = length of pipe tested, in feet <i>D</i> = nominal diameter of the pipe, in inches <i>P</i> = average test pressure during the hydrostatic test, in pounds per square inch (gauge) </p>
Flushing tests	New underground piping flushed according to _____ standard by (company) <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain
	How flushing flow was obtained <input type="checkbox"/> Public water <input type="checkbox"/> Tank or reservoir <input type="checkbox"/> Fire pump Through what type opening <input type="checkbox"/> Hydrant butt <input type="checkbox"/> Open pipe
	Lead-ins flushed according to _____ standard by (company) <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain
	How flushing flow was obtained <input type="checkbox"/> Public water <input type="checkbox"/> Tank or reservoir <input type="checkbox"/> Fire pump Through what type opening <input type="checkbox"/> Y connection to flange and spigot <input type="checkbox"/> Open pipe
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FIGURE 10.10.1 Sample of Contractor's Material and Test Certificate for Underground Piping.

Hydrostatic test	All new underground piping hydrostatically tested at _____ psi for _____ hours		Joints covered <input type="checkbox"/> Yes <input type="checkbox"/> No
Leakage test	Total amount of leakage measured _____ gallons _____ hours		
	Allowable leakage _____ gallons _____ hours		
Forward flow test of backflow preventer	Forward flow test performed in accordance with 10.10.2.5.2: <input type="checkbox"/> Yes <input type="checkbox"/> No		
Hydrants	Number installed	Type and make	All operate satisfactorily <input type="checkbox"/> Yes <input type="checkbox"/> No
Control valves	Water control valves left wide open If no, state reason <input type="checkbox"/> Yes <input type="checkbox"/> No		
	Hose threads of fire department connections and hydrants interchangeable with those of fire department answering alarm <input type="checkbox"/> Yes <input type="checkbox"/> No		
Remarks	Date left in service _____ _____		
Signatures	Name of installing contractor _____		
	Tests witnessed by		
	For property owner (signed):	Title	Date
	For installing contractor (signed)	Title	Date
Additional explanation and notes			
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FIGURE 10.10.1 *Continued*

SECTION 33 31 13
SITE SANITARY SEWERAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.
- B. Sanitary sewerage drainage piping, fittings, and accessories.
- C. Connection of building sanitary drainage system to existing on-site.
- D. Cleanout access.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Supply of connection devices to building piping for placement by this Section.

1.03 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation: Excavating of trenches.
- B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 23 23 - Fill: Bedding and backfilling.
- D. Section {id\#1000026} - {t\#1000026}: Reducing exposure of metal parts in sulfate containing soils.

1.04 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 REFERENCE STANDARDS

- A. ASTM A536 - Standard Specification for Ductile Iron Castings.
- B. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
- C. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- D. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- E. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
- F. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
- G. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

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- H. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- I. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- J. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- K. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- L. SSPWC (Greenbook) - Standard Specifications for Public Works Construction.
- M. City requirements.

1.06 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of sewer line 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.

1.07 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories.
- C. Shop Drawings:
 - 1. For pre-cast concrete sanitary manholes, including frames and covers.
 - 2. Coordination profile drawings showing sanitary sewerage system piping in elevation . Draw profiles at a horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate pipe and underground structures. Show types, sizes, materials, and elevations of other utilities crossing sewerage system piping.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- E. Project Record Documents:
 - 1. Submit documents under provisions of Section 01 78 00 - Closeout Submittals.
 - 2. Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - 3. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.08 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.
- B. Comply with requirements of Local Plumbing Code, Health Department, and Authorities having jurisdiction.

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- C. Utility Compliance: Comply with local utility regulations and standards pertaining to sanitary sewerage systems.
- D. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.
- E. Permits: Obtain all required permits in name of Owner.

1.09 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.
 - 1. Locate existing sanitary sewerage system piping and structures that are to be abandoned and closed.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate connection to public sewer with utility company.
- B. Coordinate with interior building sanitary drainage piping.
- C. Coordinate with other utility work.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Provide products that comply with applicable code(s).
- B. General: Provide pipe and pipe fitting materials compatible with each other. Where more than one type of materials or products is indicated, selection is Installer's option.
- C. Plastic Pipe: ASTM D3034, Type SDR35, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 4 to 8 inches, bell and spigot style solvent sealed joint end.
 - 1. Solvent Cement: ASTM D2564.
 - 2. Gaskets: ASTM F477, elastomeric seal.
 - 3. Pipe Joints: ASTM D3212.
- D. Joint Seals: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- E. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wyes, bends, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

- A. Cleanouts: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.
 - 1. Acceptable Manufacturers:
 - a. Ancon, Inc.
 - b. Josam Co.
 - c. Smith (Jay R.) Mfg. Co.

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- d. Wade Div.; Tyler Pipe.
 - e. Zurn Industries, Inc.; Hydromechanics Div.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.
- C. Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letters "CAUTION - SEWER LINE BURIED BELOW."
- 1. Allen Systems, Inc.; Reef Industries, Inc.
 - 2. Brady (W.H.) Co.; Signmark Div.
 - 3. Calpico, Inc.
 - 4. Carlton Industries, Inc.
 - 5. EMED Co., Inc.
 - 6. Seton Name Plate Co.
- D. Couplings: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub, and adjoining pipe outside diameter.
- 1. Gaskets: ASTM C425, rubber for vitrified clay pipe; ASTM C443, rubber for concrete pipe; ASTM C564, rubber for cast-iron soil pipe; and ASTM F477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being jointed.
- E. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wyes, bends, cleanouts, reducers, traps and other configurations required.
- F. Corrosivity Protection: All underground metallic pipe and fittings shall be protected from corrosive soils by 8 mil minimum polyethylene sheet.

2.03 CLEANOUT MANHOLE

- A. Manholes shall conform to City Standard Drawing and the SSPWC (Greenbook).
- B. Manhole Frames and Covers: ASTM A536, Grade 60-40-18, heavy-duty, ductile iron, 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover, indented top design, with lettering "SANITARY SEWER" cast into cover.
- C. Pre-cast Concrete Manholes: ASTM C478 pre-cast reinforced concrete, of depth indicated with provision for rubber gasket joints.
 - 1. Base Section: 12-inch minimum thickness for floor slab and 4.125-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
 - 2. Riser Sections: 4.125-inch minimum thickness; 48-inch diameter, and lengths to provide depth indicated.
 - 3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.

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4. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6 to 9 inches total thickness and match 24-inch diameter frame and cover.
 5. Gaskets: ASTM C443, rubber.
 6. Steps: Cast into base, riser, and top sections sidewall at 12- to 16-inch intervals.
 7. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.
 8. Channel and Bench: Concrete.
- D. Base Pad: Levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.
1. Concrete: Ready-mixed, complying with ASTM C94/C94M; Type V - Sulfate Resistant Portland cement; 3,000 psi strength at 28 days, 3 inch slump; 3/4 inch nominal size aggregate.

2.04 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Division 31 - Earthwork and applicable City or County Standards.
- B. Pipe Cover Material: As specified in Division 31 - Earthwork and applicable City or County Standards.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform work in accordance with applicable code(s).
- B. Comply with Section {id\#1000026} - {t\#1000026}.
- C. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.
- D. 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.
- E. Use fittings for branch connections, except where direct tap into existing sewer or manhole is indicated.
- F. 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.
- G. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.
 1. Place bell ends of piping facing upstream.
- H. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

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- I. No pipe shall be laid in water and all costs for drainage and/or dewatering trenches during construction shall be borne by the Contractor.

3.02 TRENCHING

- A. See Division 31 - Earthwork for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
 - 1. Correct over excavation in accordance with the Section in Division 31.
 - 2. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.
- D. If during the installation of pipe, the trench material, backfill material is found to be unsuitable, as determined by the Engineer, it shall be removed and replaced by crushed rock as defined by SSPWC (Greenbook) 200-2.2 or 200-2.3 except that minimum sand equivalent value shall be 30. Any excess material that is generated by this process shall be disposed of by the Contractor at no additional cost to the District.
- E. Bedding:
 - 1. Excavate pipe trench in accordance with the Section in Division 31 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
 - 2. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.
 - 3. Maintain optimum moisture content of bedding material to attain required compaction density.

3.03 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
- C. Unless specified otherwise, all buried piping shall have coverage of at least three feet between top of pipe and finished grade.

3.04 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Pipe Applications For Underground Sanitary Sewers
 - 1. Pipe Sizes 15 inches and Smaller: PVC gasket joint sewer pipe and fittings.
 - 2. Pipe Sizes 1-1/2 to 10 Inches: Hubless cast-iron soil pipe and fittings.
- C. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.

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- 2. Pipe shall be assembled by hand or by use of a bar and block or by lever puller. No swinging or stabbing shall be permitted. The "popping-on" of joints is expressly forbidden. All bell and spigot type connection shall be marked on the spigot end to indicate full insertion.
- D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- E. Connect to building sanitary sewer outlet and municipal sewer system , through installed sleeves.
- F. Install trace wire 6 inches above top of pipe; coordinate with the Section in Division 31 - Earthwork.

3.05 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. Join and install hubless cast iron soil pipe and fittings, with "Best" or "MG" cast-iron couplings with neoprene gaskets. Stainless steel couplings not acceptable below grade.
- B. Join and install PVC pipe as follows:
 - 1. Pipe and gasketed fittings, joining with elastomeric seals.
 - 2. Installation in accordance with ASTM D2321.
- C. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.06 INSTALLATION MANHOLES

- A. Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channels and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.
- B. Place pre-cast concrete manhole sections as indicated, and install in accordance with ASTM C891.
- C. Provide rubber joint gasket complying with ASTM C443 at joints of sections.
- D. Apply bituminous mastic coating at joints of sections.

3.07 INSTALLATION - CLEANOUTS

- A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete block 18 by 18 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installing in paving.
 - 1. Provide as shown on plans and as required by Plumbing Code.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

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3.08 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.

3.09 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Perform testing of completed piping in accordance with local authorities having jurisdiction.
- C. Request inspection prior to and immediately after placing bedding.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.
- E. 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. All sewer mains constructed and to become part of the public sewer system shall be digitally recorded by the City prior to acceptance of the sewer system for maintenance by the City.
 - 3. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.
 - 4. If requested by local utility, provide video recording of visual interior inspection.
 - 5. Reinspect after any corrections.

3.10 CLEANING

- A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
 - 2. Flush piping between manholes, if required by local authority, to remove collected debris.

3.11 PROTECTION

- A. Protect finished installation under provisions of Section 01 50 00 - Temporary Facilities and Controls.

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- B. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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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 31 23 16 - Excavation: Excavating of trenches.
- B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 23 23 - Fill: Bedding and backfilling.
- D. Section 33 05 43 - Corrosion Protection: Reducing exposure of metal parts in sulfate containing soils.
- E. Section 33 42 30 - Stormwater Drains.

1.03 REFERENCE STANDARDS

- A. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- B. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- C. 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:

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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.

2.03 PIPE ACCESSORIES

- A. 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.
- B. Filter Fabric: Non-biodegradable, non-woven , AASHTO M288 Class 2. Provide Geosynthetics 601T manufactured by ADS Advanced Drainage Systems, Inc.; www.ads-pipe.com .
- C. 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 - Excavation and Section 31 23 23 - Fill 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.

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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.
 - 3. Comply with Section 33 05 43 - Corrosion Protection.
- 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.

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- 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 District.

3.06 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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**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. Frames and grates.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 31 23 23 - Fill.
- D. Section 33 05 61 - Concrete Manholes.
- E. Section 33 42 11 - Stormwater Gravity Piping.

1.03 REFERENCE STANDARDS

- A. AASHTO HB - Standard Specifications for Highway Bridges.
- B. ACI 301 - Specifications for Concrete Construction.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- D. ACI 305R - Guide to Hot Weather Concreting.
- E. ACI 306R - Guide to Cold Weather Concreting.
- F. ACI 318 - Building Code Requirements for Structural Concrete.
- G. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- 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. 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.

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- 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, drop inlets, trench drains, 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 and approved by manufacturer.
- 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 10 according to AASHTO HB.
- B. Precast Concrete Catch Basins: Comply with ASTM C478/C478M, reinforced.
 - 1. Wall Thickness: 6 inches (152 mm).

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2. Base Thickness: 12 inches (305 mm).
 3. Joint Sealant: Comply with ASTM C990.
 4. Basis of Design Product: CBXXXX Series as manufactured by J&R Concrete Products; www.jrconcreteproducts.com, or approved equal.
- 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 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.
- E. Frames and Grates: Steel, pattern as indicated.
1. Lids and Drain Covers: Cast iron; extra heavy duty proof load; lockable; hinged.
 - a. Basis of Design Product: CBXXXX Series as manufactured by J&R Concrete Products; www.jrconcreteproducts.com, or approved equal.
 - b. At pedestrian areas provide ADA Standards compliant grates with maximum 1/2 inch wide openings. Place linear openings perpendicular to path of travel.
 - c. At vehicle traffic areas provide AASHTO HB, H-20 load rating.
 - d. Catch Basin:
 - 1) Lid Design: Linear grate.
 - 2) Nominal Lid and Frame Size: As indicated on Drawings..
 - e. Cleanout:
 - 1) Lid Design: Linear grate.
 - 2) Nominal Lid and Frame Size: As indicated on Drawings.
 - f. Area Drain:
 - 1) Lid Design: Linear grate.
 - 2) Nominal Lid and Frame Size: As indicated on Drawings.

2.02 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

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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.

3.03 INSTALLATION

- A. Establish elevations and pipe inverts for inlets and outlets as indicated in drawings.
- B. Precast Concrete Catch Basins:
 - 1. Place base section plumb and level.
 - 2. Install joint sealant uniformly around section lip.
- C. Cast-In-Place Concrete Catch Basins:
 - 1. Form catch basin according to Section 03 30 00.
 - 2. Form catch basin on excavation bottom plumb and level.
 - 3. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
 - 4. Place concrete in accordance with ACI 304R.
 - 5. Float catch basin top surface level.
- D. Frames and Grates:
 - 1. Place frame plumb and level.
 - 2. 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 District.

END OF SECTION

Grossmont Union High School District New Kitchen & Weight Room RCA Project No. 1-30-55		Stormwater Drains 33 42 30 - 4
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